JF2/ge1 4/28/2016

FILED
4-28-16
03:23 PM

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Concerning Energy Efficiency Rolling Portfolios, Policies, Programs, Evaluation, and Related Issues.	Rulemaking 13-11-005 (Filed November 14 2013)

E-MAIL RULING ATTACHING CORRECTED VERSION OF STAFF WHITEPAPER ON ENERGY EFFICIENCY BASELINES AND EXTENDING COMMENT/REPLY DEADLINES

Dated April 28, 2016, at San Francisco, California.

/s/ JULIE A. FITCH
Julie A. Fitch
Administrative Law Judge

From: Fitch, Julie A.
Sent: Thursday, April 28, 2016 12:12 PM
To: 'ahacker@co.santa-barbara.ca.us'; 'CarmelitaM@greenlining.org'; 'CCormany@EfficiencyFirstCa.org'; 'hchoy@isd.lacounty.gov'; 'lettenson@nrdc.org'; 'sswaroop@mceCleanEnergy.org'; 'tadolf@bpi.org'; 'dgilligan@naesco.org'; 'Greg.Merritt@cree.com'; 'KAnderson@OccamsConsulting.com'; 'justin@SimpleEnergy.com'; 'SDPatrick@SempraUtilities.com'; 'paul@syzergy.org'; 'Douglass@EnergyAttorney.com'; 'Douglass@EnergyAttorney.com'; 'jane.lee.cole@sce.com'; 'julie.wiley@sandag.org'; 'FOrtlieb@SanDiego.gov'; 'sachu.constantine@energycenter.org'; 'TBrill@SempraUtilities.com'; 'godero@goreadusa.org'; 'tkeith@co.slo.ca.us'; 'steve@hea.com'; 'Abhay@bidgely.com'; 'jcammarata@firstfuel.com'; Clay, Christopher; 'jeanne.sole@sfgov.org'; 'Dilini@BrightlineDefense.org'; 'hayley@turn.org'; 'CalTF@CalTF.org'; 'ek@a-klaw.com'; ' nes@a-klaw.com'; 'lkoehler@edf.org'; 'california@opower.com'; 'BCragg@GoodinMacbride.com'; 'ECL8@pge.com'; 'JerryL@abag.ca.gov'; 'JerryL@abag.ca.gov'; 'jody_london_consulting@earthlink.net'; 'bruce@builditgreen.org'; 'maldridge@ecoact.org'; 'kfoley@sonomacleanpower.org'; 'policy@efficiencycouncil.org'; 'KMessner@PoliticalLogic.net'; 'mgillette@enernoc.com'; 'Eric@CoalitionofEnergyUsers.org'; 'jim.hawley@deweysquare.com'; 'tenslow@adamsbroadwell.com'; 'TEnslow@adamsbroadwell.com'; 'john@clfp.com'; 'kmills@cfbf.com'; 'SamS@jacoinc.net'; 'tom@ucons.com'; 'jake@energysavvy.com'; 'A8S8@pge.com'; 'oxv5@pge.com'; 'Alejandra.Mejia@futee.biz'; 'astover@mceCleanEnergy.org'; 'allen.lee@cadmusgroup.com'; 'arago@qcsca.com'; 'akp.servicelist@gmail.com'; 'acampbell@haas.berkeley.edu'; 'Annette.Beitel@futee.biz'; 'akawnov@yahoo.com'; 'barbara@barkovichandyap.com'; 'bmenten@mceCleanEnergy.org'; 'b2sg@pge.com'; 'cyin@yinsight.net'; 'ccchen@san.rr.com'; 'RegRelCPUCCases@pge.com'; 'ccfe@pge.com'; 'californiadockets@pacificorp.com'; 'charlie.buck@opower.com'; 'CSierzant@semprautilities.com'; 'Cory.scott@pacificorp.com'; 'craigtyler@comcast.net'; 'dfranz@solarcity.com'; 'davidh@greenlining.org'; 'd6cx@pge.com'; 'Eli.Harland@energy.ca.gov'; 'eric.eberhardt@ucop.edu'; 'Greg.Wikler@Navigant.com'; 'hanna.grene@energycenter.org'; 'jean.shelton@itron.com'; 'Jennyb@abag.ca.gov'; 'jenny.roecks@futee.biz'; 'JWaen@mceCleanEnergy.org'; 'jcohen@isd.lacounty.gov'; 'john.cavalli@itron.com'; 'kelliott@mceCleanEnergy.org'; 'klr@a-klaw.com'; 'kirs.bradley@itron.com'; 'Lindsey.Hawes@energycenter.org'; 'LLAA@pge.com'; 'lmedina@semprautilities.com'; 'mcosta@energycoalition.org'; 'mstamas@nrdc.org'; 'marthaagarcia@semprautilities.com'; 'regulatory@mceCleanEnergy.org'; 'mborgeson@nrdc.org'; 'mpa@a-klaw.com'; 'mnguyen@energycoalition.org'; 'm1nz@pge.com'; 'wmc@a-klaw.com'; 'mike.rufo@itron.com'; 'mistib@comcast.net'; 'nikhilvgandhi@gmail.com'; 'PatrickFerguson@dwt.com'; 'pthacher@mcecleanenergy.org'; 'rachel.harcharikl@itron.com'; 'rafi@pge.com'; 'ramon@ucdavis.edu'; 'RNash@sfwater.org'; 'SHarvey@kfwLaw.com'; 'sfable@bki.com'; 'sephra.ninow@energycenter.org'; 'shahana.samiullah@sce.com'; 'Sharyn.barata@itron.com'; 'sguerry@bki.com'; 'tolsen@energycoalition.org'; 'dietrichlaw2@earthlink.net'; 'mrw@mrwassoc.com'; 'filings@a-klaw.com'; 'rekl@pge.com'; 'jperkins@ers-inc.com'; 'diamond@energyhub.net'; 'kier@energyhub.net'; 'rhupart@solarelectricpower.org'; 'KJohnson@JohnsonConsults.com'; 'rholmes@arcainc.com'; 'jcameron@arcainc.com'; 'kcrandall@kfwlaw.com'; 'lisa@simpleenergy.com'; 'adam@simpleenergy.com'; 'ca@e9insight.com'; 'pjacobs@buildingmetrics.biz'; 'cynthiakmitchell@gmail.com'; 'ibc1@nvbel.net'; 'awilliamson@semprautilities.com'; 'anih@SempraUtilities.com'; 'ASteinberg@SempraUtilities.com'; 'DHanway@SempraUtilities.com'; 'DKim@semprautilities.com'; 'EBaires@SempraUtilities.com'; 'JLSalazar@SempraUtilities.com'; 'jjmartinez@semprautilities.com'; 'JKwok@SempraUtilities.com'; 'layala@semprautilities.com'; 'mjhervey@semprautilities.com'; 'RVanderleeden@SempraUtilities.com'; 'CHVaquerano@SALEF.org'; 'David.Cohen@energycenter.org'; 'Mabell.Paine@icfi.com'; 'lena@southbaycities.org'; 'dlowrey@comverge.com'; 'klatt@energyattorney.com'; 'case.admin@sce.com'; 'charisse.burnett@sce.com'; 'Frank.Harris@sce.com'; 'janet.combs@sce.com'; 'Liddell@EnergyAttorney.com'; 'afaustino@semprautilities.com'; 'CentralFiles@SempraUtilities.com'; 'JYamagata@SempraUtilities.com'; 'ABesa@semprautilities.com'; 'Paul.Marconi@bves.com'; 'James.J.Hirsch@gmail.com'; 'johnavina@abraxasenergy.com'; 'dtozlian@rhainc.com';

'sstolte@smcgov.org'; 'nick.brod@clearesult.com'; 'kathleen.bryan@sfgov.org'; 'ann.kelly@sfgov.org'; 'cal.broomhead@sfgov.org'; 'ETorres@turn.org'; 'jguild@enovity.com'; 'amul.sathe@navigant.com'; 'AAF0@pge.com'; 'bperlstein@kpmg.com'; 'cara.goldenberg@grueneich.com'; 'derek.jones@navigant.com'; 'GXPR@pge.com'; 'MAGq@pge.com'; 'M3AK@pge.com'; 'm2ld@pge.com'; 'PXJJ@pge.com'; 'rysk@pge.com'; 'golding@communitychoicepartners.com'; 'JStoddard@crowell.com'; 'JJaffe@Nossaman.com'; 'm3fi@pge.com'; 'skrasnow@firstfuel.com'; 'mmattes@nossaman.com'; 'david@energysavvy.com'; 'Alejandra.Mejia@futee.biz'; 'cem@newsdata.com'; 'MeganMMyers@yahoo.com'; 'ssmyers@att.net'; 'andrew.yip@us.bosch.com'; 'RCounihan@NestLabs.com'; 'dianmg52@gmail.com'; 'David.Siddiqui@clearesult.com'; 'bonnie.datta.ext@siemens.com'; 'MDoran@MCECleanEnergy.org'; 'andrew@arc-alternatives.com'; 'jim@betterclimate.info'; 'floyd.keneipp@tierrarc.com'; 'd1tq@pge.com'; 'cadickerson@cadconsulting.biz'; 'allan@luciddg.com'; 'Chenrikson@trcsolutions.com'; 'fred.coito@dnvgl.com'; 'harnold@opiniondynamics.com'; 'jmj@opiniondynamics.com'; 'mgardner@efficiencycouncil.org'; 'msutter@opiniondynamics.com'; 'mharamati@opiniondynamics.com'; 'NMerchantVega@opiniondynamics.com'; 'opatterson@opiniondynamics.com'; 'stephanie.wang@energycenter.org'; 'tbuhr@opiniondynamics.com'; 'TPope@energy-solution.com'; 'TLindl@kfwlaw.com'; 'service@cforat.org'; 'JSKromer@mac.com'; 'elvine@lbl.gov'; 'john@proctoreng.com'; 'MCallahan-Dudley@mceCleanEnergy.org'; 'hankryan2003@yahoo.com'; 'demetra.mcbride@ceo.sccgov.org'; 'natalie.deleon@ceo.sccgov.org'; 'dreynolds@ers-inc.com'; 'Justin.Leveque@SanJoseCa.gov'; 'lcasey@sctainfo.org'; 'anne.policysolutions@gmail.com'; 'dgrandy@caonsitegen.com'; 'kheinemeier@ucdavis.edu'; 'smita.gupta@itron.com'; 'dhou@caiso.com'; 'jpinjuv@caiso.com'; 'Griffiths@BraunLegal.com'; 'jdecker@lgc.org'; 'joldham@lgc.org'; 'RobertPrm@gmail.com'; 'STaheri@scppa.org'; 'blaising@braunlegal.com'; 'ssanders@ca-ilg.com'; 'steven@iepa.com'; 'tbrunello@greentechleadership.org'; 'dcardozo@adamsbroadwell.com'; 'rob@clfp.com'; 'jasong@energysavvy.com'; 'dmoran@nexant.com'; 'johnwgould@comcast.net'; 'michael.r@twavetech.com'; 'emibd@emiconsulting.com'; Lu, Aaron; Tran, Ava N.; Best, Carmen; Fogel, Cathleen A.; Myers, Christopher; Buch, Daniel; 'David.Ismailyan@energy.ca.gov'; Peck, David B.; Mackin, Dina S.; Reynolds, Frank Alan; Fortune, Hazlyn; Clinton, Jeanne; Tagnipes, Jeorge S.; Battis, Jeremy; Gubman, Joanna; Hardy, Katherine; Wu, Katie; Kajopaiye, Kayode; Paulo, Lisa; 'Martha.Brook@energy.ca.gov'; Colvin, Michael; Dzvova, Mona Dee; 'psaxton@energy.state.ca.us'; Gruendling, Paula; Franzese, Peter; Lai, Peter; Skala, Pete; Cox, Rory; Francisco, Tory; Cole, Alexander; Caron, Jennifer; Kalafut, Jennifer; Fitch, Julie A.; Odunlami, Lola; Zhang, Zhen; 'crogers@energy.state.ca.us'
Cc: ALJ Docket Office; ALJ Process; ALJ_Support ID
Subject: R.13-11-005: Email ruling attaching corrected version of Staff White Paper on Energy Efficiency Baselines and extending comment/reply deadlines

Parties to R.13-11-005:

It has come to my attention that an incorrect version of the Staff White Paper on Energy Efficiency Baselines was inadvertently attached to the Ruling issued April 21, 2016 seeking comment on the staff white paper. Attached to this email ruling is the correct version of the white paper, on which comment is requested from parties.

The changes in the attachment are confined to Section V.C.3 related to "Recommendations for Counting Savings" plus the substitution of a corrected

Figure 3: "Proposed Baseline Framework." There are no changes to the Navigant Technical Analysis that was also attached to the April 21, 2016 ruling.

Because of this error in publishing the incorrect staff white paper attachment, I am extending the comment and reply comment deadlines. Comments will now be due **May 17, 2016** and reply comments **May 24, 2016**. Apologies for the inconvenience.

If you have any questions, please let me know.

The Docket Office shall formally file this email ruling.

Best regards,

Julie A. Fitch
Administrative Law Judge
California Public Utilities Commission
(415) 703-3134

ATTACHMENT

Staff White Paper on Energy Efficiency Baselines

For Implementation of
Assembly Bill 802

Prepared by:
California Public Utilities Commission
Energy Efficiency Program Branch, Energy Division

CORRECTED VERSION
APRIL 27, 2016

Table of Contents

I. Overview

The purpose of this white paper is to provide CPUC staff recommendations on how an "existing conditions" baseline should be applied in estimating utility energy efficiency program savings, as required by Assembly Bill (AB) 802.[1] This white paper discusses challenges in implementation of AB 802 and offers a proposal that strikes an appropriate balance between AB 802's explicit direction to define energy efficiency savings as based on existing conditions with its direction that the CPUC identify instances in which the existing conditions would not be an appropriate baseline.

Sections II through IV provide relevant background information on energy consumption baselines and the challenges associated with establishing them. Section V describes the various technical analyses staff used in developing its recommendations, and Section VI provides staff's recommendations. Finally, Section VII draws some conclusions, including the identification of additional work and analysis that could be performed in the future to improve upon the initial baseline policies the CPUC establishes to meet AB802's September 2016 deadline.[2]
Key staff recommendations in this paper include:

- The appropriate baseline (i.e., existing conditions or code) can be identified and applied broadly for certain programs, while for other programs the appropriate baseline depends on the measure or other situation-specific conditions.
- To reduce the amount of savings claim complexity and controversy CPUC policy and program administrator portfolio design efforts should focus on transitioning significant portions of the energy efficiency program portfolios to the programs directed in AB 802.
- To reduce the potential for utility staff or contractors to engage in wasteful or fraudulent conduct now that legally-required activities are eligible for utility energy efficiency savings credit, portfolio goals should be set as net of free-ridership.

II. Background and Policy Framework

A. What is a Baseline?

In Decision 14-10-046, the CPUC laid out a basic explanation of baselines and why they matter in energy efficiency policy. The discussion provides a useful summary for the remainder of the white paper.

---

[1] Text of AB 802 is available at http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802

[2] AB 802 requires that the CPUC shall, by September 1, 2016, authorize electrical corporations or gas corporations to provide financial incentives, rebates, technical assistance, and support to their customers to increase the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions, taking into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings.

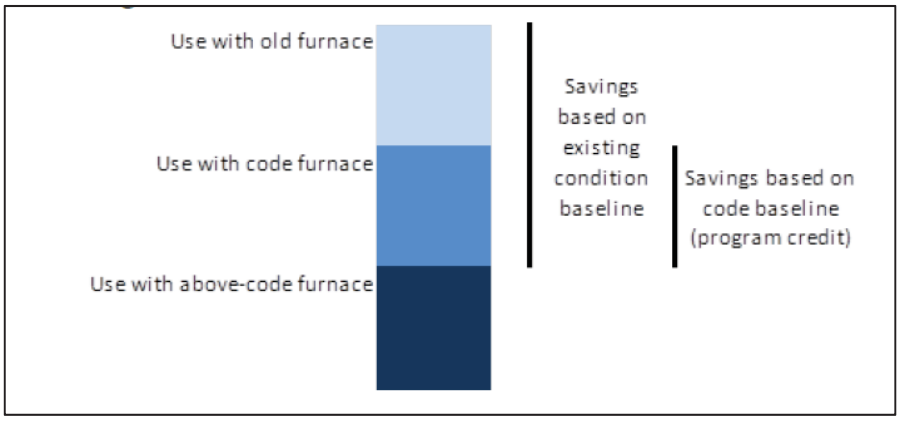
Part of what makes EE [energy efficiency] so complex is that savings – i.e., the absence of use – is a difficult thing to measure. Figuring out what you saved requires figuring out what you would have consumed without the efficiency measure. This hypothetical level of consumption is the "baseline," and it is the point of comparison for determining savings.

The consequences of a baseline choice ramify through all aspects of EE calculations. The baseline choice affects, among other things, the existence or amount of savings, customer eligibility for incentives, amount of incentives, whether a PA meets its Commission-established savings goals, and the award of shareholder incentives.

In general, the lower the baseline – the easier it is to show (or to show more) savings. A higher baseline makes that showing harder. An oversimplified hypothetical illustrates why. Assume for a moment that a customer replaces an old gas furnace with a high-efficiency gas furnace that exceeds code requirements.

- *Existing conditions baseline savings = (gas used with old furnace) - (gas used with the new furnace).*
- *Code baseline savings = (gas used with a "to-code" furnace) – (gas used with the new "above-code" furnace).*

Figure 1: Illustration of Savings Counted in Existing Conditions and Code Baselines



The difference in energy use between an old furnace and a new, "above-code" one is essentially guaranteed to exceed the difference between a new "to-code" furnace and a new "above-code" furnace. In EE parlance, the "existing conditions" baseline is a "lower" baseline; it is easier to show savings when comparing new equipment to existing equipment than when comparing new equipment to equally new, albeit less-efficient, "to-code" equipment.

In Decision 14-10-046, the CPUC decided not to accept alternative baselines, opting instead to continue with the existing process of defining baselines in the portfolio and consider any changes to baseline policy in a later phase of the proceeding.

One other definitional point of note is that in this paper, the concepts of "baseline," "attribution" and "free ridership" are so inter-related as to seem inter-changeable. For traditional programs delivering above-code energy savings, determining net savings is a two-step process in which gross savings are first determined based on a (gross) baseline, then a net-to-gross ratio is used to remove savings from free riders to determine net savings. However, for below-code savings, it is much more difficult, if not impossible, to separate these steps, since the replacement of burned-out equipment with code-minimum equipment will occur regardless of whether a program provides incentives, since in many cases, it is the customer's only option. Providing incentives for *these types of replacements* results in 100% free-ridership.

B. Direction of AB 802 and SB 350

In October of 2015, Assembly Bill 802 and Senate Bill 350 became California law.

SB 350 requires the state to double energy efficiency savings by 2030.[3] To achieve this goal, SB 350 directs the California Energy Commission (CEC) to set targets, in consultation with the CPUC, for each investor-owned utility (IOU). It also directs the CPUC to authorize the following new programs when feasible and cost-effective:

- Programs and projects that quantify a change in energy consumption at the meter, utilizing existing conditions as the baseline, subject to adjustments (normalization) for weather, occupancy, equipment standards (excluding Title 24), etc.;
- Market transformation programs with appropriate levels of funding to achieve deeper energy efficiency savings;
- Pay for performance programs that link incentive payments to actual energy savings achieved; and
- Behavioral, retrocommissioning, and operational programs.

AB 802, adopted as a companion bill with provisions that support the goals of SB 350, requires the CPUC to authorize new energy efficiency and conservation programs that "measure overall energy usage reductions" for "modifications to existing buildings to bring them into conformity with, or exceed, the requirements of Title 24," as well as for behavioral, retrocommissioning, and operational measures. The statute provided the CPUC with discretion to determine the exceptions to the use of an existing conditions baseline. The legislation did not address how the CPUC should treat equipment standards (e.g. Title 20 and Federal standards) in baseline determination or industrial processes where equipment is often installed based on industry standard practice (ISP).

[3] The [California Energy] Commission shall base the targets on a doubling of the mid- case estimate of additional achievable energy efficiency savings, as contained in the California Energy Demand Updated Forecast, 2015-2025, adopted by the Commission, extended to 2030 using an average annual growth rate.

AB 802 specifically directs the CPUC to "take into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings." Normalized metered energy consumption refers to the overall reduction of energy consumption, as measured through direct metering, and then normalized to account for exogenous factors, such as weather and occupancy. It also requires the CPUC to count savings towards goals based on normalized metered energy consumption when feasible and cost-effective.

As a preliminary step towards implementation, AB 802 also directed the CPUC to allow "high opportunity projects or programs" to be authorized by January 1, 2016. As required by the legislation, the CPUC issued guidance on the submission of new programs and projects via an Assigned Commissioner's Ruling on December 30, 2015.

III. Challenges and Implications in Establishing Baseline

California's legislative framework treats energy efficiency as a procurement resource alongside gas and renewable generation; it is a critical component of the statewide planning for meeting demand and achieving greenhouse gas reductions. It is the customer-facing resource that has the largest impact on the demand forecast – it was forecast to effectively flatten load growth over the next decade even before the doubling of energy efficiency goals included in SB350. Since the intent of SB 350 and AB 802 is to reduce carbon emissions, shifting to existing conditions baselines is ineffective if we simply log savings that were already happening or counting them in both the forecast and the program claims. The challenge to doubling energy efficiency is that there is a significant amount of efficiency savings that is already expected to be achieved through existing utility programs and the adoption of codes and standards updates, and that the savings from application of those codes and standards to regular equipment replacement have already been built into the demand forecast.

The rationale underlying AB 802 is that savings from codes and standards have been overestimated due to non- compliance due to deferred retrofits and avoiding permits or code triggers. However, these market activities are hard to quantify.[4] In order to assess the impact that implementing an existing conditions baseline policy will have toward meeting the targets set in SB 350, versus crediting utility programs with savings that were already occurring in the economy, the CPUC has been working with the CEC to assess:

- **Stranded potential:** Energy efficiency opportunities that are not currently eligible for rebates because most or all of the savings below code, but are not getting captured in

[4] The current Codes and Standards Impact Evaluations are collecting data on permitting and compliance for retrofits, further discussed in Section IV.C.

natural building upgrades and turnover, either because of non-compliance of code or deferred retrofits.[5].

- **Potential double counted savings:** Some codes and standards savings are already assumed to be occurring in the forecast for existing buildings and should remain there because the measures are being adopted at the expected pace with no program interventions (i.e., no market barriers need to be overcome to foster measure adoption); the potential for double-counting occurs if these measures *also* receive credit as utility program savings under new existing conditions baseline rules.

Without careful implementation, AB802 could result in a portfolio of projects delivering meter-verified energy savings made up largely of upgrades that were already occurring in the economy. **This new portfolio could consume a significantly larger budget yet deliver far less additional savings per dollar of ratepayer investment than the portfolio has historically delivered.**

As an example, if it is not carefully designed, a shift to existing conditions baselines could incentivize program implementers to set up stations outside permitting offices, offering rebates to passing contractors who had already received a permit and would have complied with codes and standards regardless. This was certainly not what the state had in mind in adopting this new definition of energy efficiency, and there are opportunities to prevent this unintended consequence and for the utility portfolios to deliver significant quantities of real and additional efficiency savings to help meet the state's carbon goals. The purpose of this paper is to illustrate these challenges and offer a proposal that strikes an appropriate balance between AB 802's explicit direction to define energy efficiency savings as based on existing conditions with its direction that the CPUC identify instances in which the existing conditions would not be an appropriate baseline.

While recognizing these potential unintended consequences, staff has developed the analysis and proposal in this white paper under the assumption that the state enacted AB 802 in consideration of these concerns, and with a willingness to risk a manageable amount of ratepayer dollars to achieve its aggressive greenhouse gas goals. Consequently, in our analysis and proposal, we have erred on the side of recommending the use of an existing conditions baseline in many of the gray areas that exist, under the assumption that if evaluations indicate that a limited set of exceptions are resulting in an unacceptable level of waste and double-counting of savings, the CPUC can expand its exceptions to the use of existing conditions baseline in response to these evaluations.

[5] Stranded potential may or may not be include (i.e., assumed to occur and therefore reduce) the demand forecast, but that aren't actually happening at the pace assumed in the forecast. For some types of alterations, the demand forecast may overestimate the savings realized, and for other types it may be underestimated.

IV. CPUC's Baseline Analysis Process

To implement a baseline policy based on existing conditions for energy efficiency programs, AB 802 directed the CPUC to consider the results of an interagency baseline assessment, available results from the IOU baseline pilot studies ordered in D.14-10-046, and information necessary to ensure consistency with CEC's energy forecast and planning functions.

This section provides an overview of the work products of the interagency baseline assessment that inform the staff proposal. In addition to the Technical Analysis, these work products include an analysis produced by CEC staff discussing how codes and standards are implemented in existing buildings and counted in the demand forecast. It also discusses the results of the codes and standards evaluation studies as they inform the staff proposal.

Results are not yet available from baseline pilots,[6] so this white paper relies on information provided by Navigant and CEC staff to inform its recommendations; staff assumes that after the pilot programs are completed and other sources of information become available that shed light on below-code savings issues, the CPUC may revisit the initial policy it develops to comply with the September 2016 program authorization date required by AB 802.

A. AB 802 Technical Analysis

Since 2010, Navigant Consulting has prepared the Potential and Goals Study, which has been used to establish energy savings targets for IOU energy efficiency program and energy procurement planning. As part of the current Potential and Goals Study update process and in response to AB 802, Navigant has prepared an initial technical analysis to assess the stranded potential of savings up to code (savings not being captured or realized because consumers are not upgrading their equipment), as well as the potential for double counting of energy efficiency savings (that were already accounted for in the CEC's load forecast).

This technical potential analysis was conducted by modifying the existing Potential and Goals model that informed the 2015 IOU goals to account for increased program uptake (customer participation) anticipated with the additional incentive and savings value.[7] The modifications to the model were mainly limited to the simulation of additional decisions by the consumer to repair rather than replacement of broken equipment, the consideration of repair costs, and the setting of incentive levels considering the full measure cost.

This analysis provides insight on how the use of an existing conditions baseline would impact the market for deemed measures and some whole-building calculated measures, as

[6] SCG's to-code pilot study is just now getting underway, and the other IOUs' studies have not yet begun. Consequently, preliminary results are not expected until 2017. A full summary of the current status of the pilots are attached to this paper as Appendix D.

[7] Potential and Goals Studies can be viewed at http://cpuc.ca.gov/General.aspx?id=2013

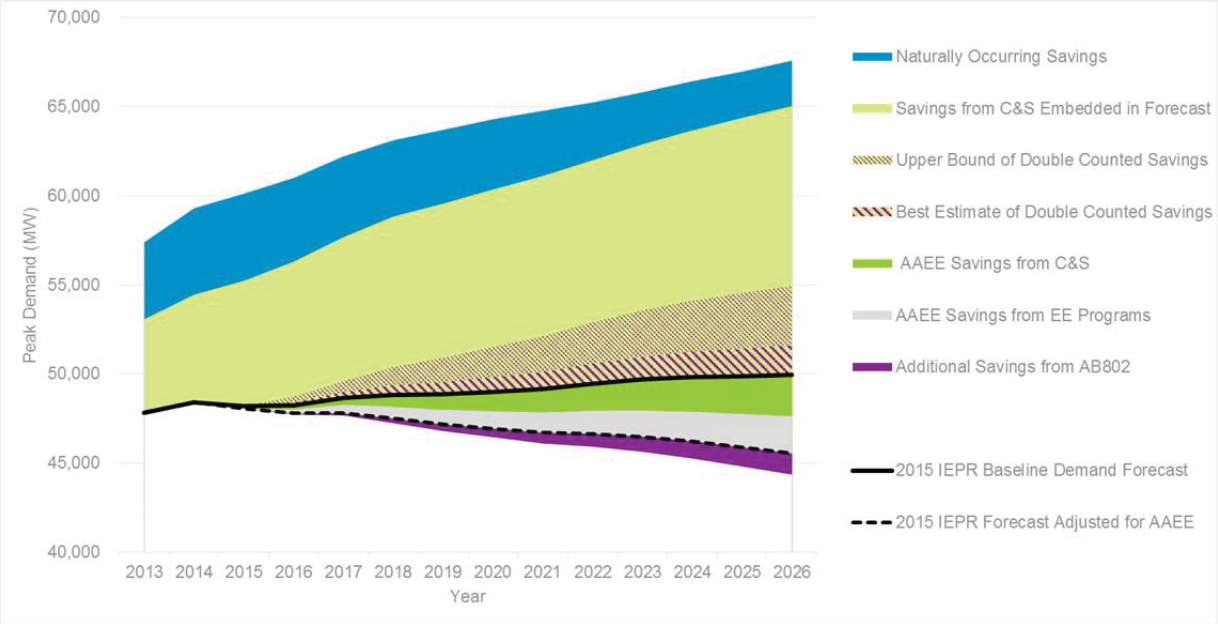
well as retrocommissioning and operational activities. The analysis will require further research to inform the process of setting goals for 2018 and beyond. The impacts of building envelope and building systems, which use metered approaches for estimating savings, could not be calculated using Navigant's current methodology. Assessing the total stranded savings potential below code in existing buildings will need to be an iterative effort, as we seek out new methods and data. Navigant's full Technical Analysis is attached to this white paper as Appendix B.

Summary of findings from Navigant's Technical Analysis

Figure 1 shows the potential impact of AB 802. Because we believe the intent of the new baseline requirements is to allow new programs that achieve additional energy efficiency savings and lower the overall demand forecast in the future, a significant amount of the potential savings, represented by all wedges above the black solid line, will already occur when equipment is replaced and buildings are retrofit. Savings from the wedges below the black dotted line are considered additional savings. There is a **significant amount of uncertainty in estimates of stranded potential and double counting**, which depend on analysis that is ongoing and was not completed in time to be included in this white paper.[8]

[8] Because the current Navigant Potential and Goals Study model was originally built to calculate the potential of energy efficiency savings above code, the measures and methods in the model designed to capture existing conditions potential may need further consideration.

Figure 2: Cumulative Impact of AB802 on the CEC Demand Forecast



Source: Navigant Analysis

Incremental savings potential, represented by the purple wedge below the dotted line, due to changes in baseline contemplated by AB 802 come from three potential sources:

1. Additional energy efficiency savings above code requirements that now would result from a program's ability to pay for some below-code measures, resulting in more comprehensive and deeper projects overall (this could include more activities commonly referred to as "to and through code" projects),

2. Below code savings potential that had been truly "stranded," (i.e., project activities that would not have occurred at all otherwise)

3. Behavioral, retrocommissioning, and operational efficiency activities.

These sources combined account for an estimated 1192 MW in additional avoided electric peak capacity, 5,669 GWh of electricity, and 6 MMtherms of natural gas by 2026.[9] Lighting and Heating, Ventilation and Air Conditioning (HVAC) represent the major sources of electric savings, and hot water represents the major source of natural gas savings.
The double-counted savings that were already reflected in the demand forecast (best estimate and upper bound) reflect savings that can qualify for incentives and the IOUs may

[9] These are additional cumulative savings to the 2015 P&G. Natural gas savings include consideration of lighting interactive effects.

take credit and be compensated for, but would have already been captured through regular turnover when this equipment was replaced on burnout. This amount has already been appropriately accounted for in the forecast as codes and standards savings, and has been credited proportionally to the IOUs for their support of codes and standards advocacy in the CEC's periodic processes for establishing codes and standards. The best estimate of double counted electric peak capacity savings amounts to approximately 1,680 MW, 4,592 GWh and 95 MMtherms[10] also primarily resulting from lighting and HVAC.[11] This means that while AB 802 directs the CPUC to relax restrictions on what qualifies for incentives, the technical analysis found that **the potential for double counting may be as significant as the stranded and operational potential for additional savings.**

B. CEC Assessment of Codes and Standards

Implementation of SB 350 and AB 802, and in particular the development of IOU program goals and efficiency forecast for procurement and reliability planning, requires close coordination between the CEC and CPUC. CPUC staff needs to better understand how Codes and Standards are applied to existing buildings, and what energy efficiency savings the CEC has forecasted to be achieved through compliance with codes and standards. To avoid double-counting IOU efficiency program savings (which could result in grid reliability impacts) or undercounting these savings (which could result in over-procurement of supply-side resources, wasting ratepayer funds needed to achieve the state's aggressive GHG goals in productive ways).

The legislation requires the CEC to make modifications to the demand forecast to account for the impacts that occur as a result of existing conditions baseline. Similarly, the CPUC may also need to take up the issue of whether it is appropriate to continue to support and give credit (in the form of crediting of energy efficiency savings toward their goals) to the IOUs for their codes and standards advocacy work at the CEC.

The CEC's assessment on energy efficiency occurring in existing buildings and the stranded potential for savings below code available is attached in Appendix C. Appendix C discusses:

- How Title 24 is implemented in existing buildings
- The CEC Efficiency Division's assessment of stranded below code potential
- How energy efficiency is counted for procurement planning

[10] Therms savings include interactive effects.

[11] The upper bound estimate results in 5,000 MW in 2026, which is based on the assumption of all C&S savings from retrofits in the model being double counted. Navigant acknowledged this is an unreasonable assumption and decided to narrow the scope to only measures that could be more reasonably at risk of being double-counted.

- Considerations for CPUC's implementation of AB 802 and future directions for codes and standards.

C. Codes and Standard Impact Evaluations

CPUC staff has overseen several studies assessing how codes and standards affect the energy efficiency industry. These evaluations are conducted to assess the energy savings the IOUs can claim for the Codes and Standards (C&S) programs, which made up 46% of the portfolio savings in 2010-2012. As part of the C&S Impact Evaluation Protocol,[12] the evaluators must determine compliance with building codes and appliance standards in order to true-up IOU energy savings claims.

- **Lighting Retrofits:** Historically, there have been a limited number of assessments of compliance with standards for retrofits completed. This is because it is difficult to sample retrofit projects that do not participate in programs, and especially projects that are completed without permits. However, the 2010-2012 C&S Impact Evaluation found in a statistically significant sample for interior lighting retrofits that the compliance for permitted projects was 108%, meaning that savings were 8% greater than if projects had just met code requirements and not exceeded them.[13] IOUs are currently conducting a study to investigate which code requirements and how many sampled buildings drove the high compliance rates with the 2008 Title 24. Commission staff will lead additional studies to better understand compliance with lighting retrofits, including unpermitted installations if possible.

- **HVAC:** CPUC staff is overseeing a HVAC Market Assessment to determine the level of compliance with Title 24 requirements for both permitted and unpermitted HVAC retrofit installations.[14] The preliminary findings show only 35% of HVAC

[12] California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals, 2006. Codes and Standards and Compliance Enhancement Evaluation Protocol Chapter http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5212

[13] Savings were 8% greater than if projects had just met code requirements and not exceeded them. Statewide Codes and Standards Program Impact Evaluation Report For Program Years 2010-2012 http://calmac.org/publications/CS_Evaluation_Report_FINAL_10052014-2.pdf

[14] Research Plan for HVAC Permit and Code Compliance Market Assessment (http://www.energydataweb.com/cpucFiles/pdaDocs/1239/HVAC%20WO6%20Final%20MAPC%20Research%20Plan_25Feb2015.pdf) Results for gas requirements were inconclusive due to high error bounds. A similar study led by PG&E found similar results but was based on different methods and much smaller samples - HVAC Permitting: A

Footnote continued on next page

replacements were permitted.[15] Nevertheless, the results also found that code requirements were met 79% of the time for permitted installations and 60% of the time for unpermitted installations. When modeling the code requirements for electric savings, the study preliminary results found 70% compliance for permitted installations and 64% for unpermitted with no statistical significant difference between the compliance rates.

This research is still ongoing, but preliminary results[16] indicate that even though the permitting rate is low (approximately 35%), **there are similar rates of compliance regardless of the permit status.** In addition, there is less of a distinction in compliance between permitted and non-permitted HVAC retrofits than generally assumed in the absence of field data. Yet, for both permitted and unpermitted installations, there is an opportunity to improve compliance.

Finally, there has been research to identify barriers to code implementation and enforcement to inform compliance improvement activities.[17] Based on the findings from the IOU/BayREN Compliance Improvement Program Process Evaluation,[18] building department survey respondents pointed to complexity of compliance forms, workload, frequent changes to the energy code, lack of understanding of code language, and lack of availability of in-depth training as still major challenges.

D. Ruling on High Opportunity Programs and Projects (HOPPs)

The Assigned Commissioner's Ruling issued on December 30, 2015 in Rulemaking (R.) 13-11-005 defined a framework for how to implement "high opportunity programs and projects"

Study to Inform IOU HVAC Programs
http://calmac.org/publications/FINAL_REPORT_PGE_HVAC_Permitting_for_IOU_Programs_Study_v20141010.pdf

[15] Specifically, the preliminary findings show 65% were unpermitted and 26% had a finalized permit and 9% permits were open or expired.

[16] Preliminary draft of HVAC Market Assessment can be found at
http://www.energydataweb.com/cpuc/search.aspx

[17] Compliance Improvement Advisory Group (http://www.caciag.com/Issues); IOU Led Best Practices Pilot Report (2012)(http://www.energycodeace.com/download/3256/file_path/fieldList/T24%20BPP-FINAL%20DRAFT-Report%20and%20App_Updated%204.13.pdf; BayREN 2014 Permit Resource Opportunity Program – PROP (2014) (https://www.bayren.org/codes/prop-final-report)

[18] IOU/BayREN Compliance Improvement Program Process Evaluation can be found at
http://www.energydataweb.com/cpuc/search.aspx

by January 1, 2016, as directed in PU Code 381.2.[19] The ruling established a proposal template and review process for new programs, guidelines for implementing normalized metered energy consumption (metered) methods, and program design considerations.

This also ruling establishes the initial policy guidelines for implementing metered approaches and the appropriate application of baseline in these types of programs. Staff proposes that the HOPPs framework continue to be used within the broader implementation of AB 802. This white paper expands on the framework by specifying to which elements of the portfolio these approaches should or should not apply. Implementation of metered approaches to measuring savings enables new types of programs. This approach was seen as an opportunity to take advantage of the advanced metering infrastructure within the IOU territories, existing protocols to guide M&V at the point of deployment, and the advent of software solutions to enable cost-effective interventions remotely or with lower-cost ex post verification needed. We expect that leveraging metered approaches when feasible or cost-effective will support:

- Better understanding the performance of energy efficiency programs to inform forecasting, procurement, and planning.

- Innovative program design that rewards energy efficiency based on performance, be it by way of incentives or other delivery mechanisms such as finance.

- The ability to capture savings from multi-measure, whole building approaches, including savings from behavioral, retrocommissioning, and operational measures and provides insight into the persistence of those savings.

- Facilitate interventions for previously unreached market opportunities in existing buildings by creating a continuous stream of savings value from participating customers committed to making and maintaining behavioral and operational improvements.

- Potential improvements to ex post evaluation, measurement and verification by embedding measurement strategies into program design to track and verify as the program is implemented.

The transition to metered approaches will involve several challenging tasks. These challenges include, but are not necessarily limited to:

- Developing methods to forecast savings from programs using metered approaches,

[19] December 30, 2015 Ruling on "High Opportunity Programs and Projects can be viewed at http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M157/K362/157362236.PDF

- Designing reporting processes that are able to handle post implementation true-ups and track persistence,

- Designing and implementing programs based on ex-post savings claims,

- Managing the upfront review process to ensure that the methods are robust enough to have confidence in the results, but provides enough flexibility for experimentation.

We expect to address these issues as we learn from HOPPs and Business Plan submissions and the review process. Hence, at this time we are not proposing changes to the framework for metered approaches or the guidance for HOPPs.

E. January 2016 Workshop

Commission staff held an informal workshop on January 26-27, 2016 to discuss the policy and methodological issues involved in implementing existing conditions baseline and metered evaluation approaches. Presentations and informal comments were posted on the CPUC website.[20]

Day 1: Policy Considerations for Implementing Existing Conditions Baseline

On the first day of workshops, panelists considered the implications of implementing an existing conditions baseline and how to define the policy framework to enable new approaches to capture stranded potential but also mitigate the impacts of double counting. Among the many valuable points raised, staff identified these key take-aways to inform our proposal for AB 802 implementation:

- Besides standard lighting equipment and small HVAC packaged units, for which there is comprehensive saturation data, there is a lack of useful data available to determine the stranded potential of energy savings up to code, in particular for building envelope, which is a significant focus of AB 802. Thus, the CPUC will need to establish policies and set targets without a complete view of the stranded potential and potential double counting.

- Stakeholders acknowledged that the potential adverse consequences of applying existing conditions baseline too broadly were real, in that ratepayer funds could be significantly diverted to activities that were already occurring without ratepayer funding support, so there needed to be exceptions in the application of the baseline. However,

[20] These materials are available at: http://www.cpuc.ca.gov/general.aspx?id=4130

stakeholders made clear that it was just as important that the regulatory rules did not impede effective delivery of energy efficiency programs to customers.

- The savings that our existing efficiency programs have been especially effective at capturing—substantially focused on rebates for deemed measures that are replaced after equipment failure—are the types of savings that are at the greatest risk for significant double counting.

- Assignment of attribution (responsibility for causing an upgrade or efficiency investment to occur) is the key to shifting to an existing conditions baseline, and can address many of the free-ridership concerns raised in the first point above, *for well-designed programs.* However, net-to-gross surveys can be problematic and not that helpful in identifying program influence. Thus, we need to explore alternate methods to determining program attribution, such as randomized control trials and/or dynamic baselines.

- Metered evaluation approaches work well for some but not all types of energy efficiency projects. They particularly work well for buildings and end uses with predictable and comparable load profiles (which allow for normalization), while they are more problematic for more customized processes, for which a number of unique factors might be affecting the building load. Thus, the CPUC should not expect metered approaches to be universally applied.

Day 2: Normalized Metered Energy Consumption (NMEC)

On the second day of the workshop, panelists discussed methods, opportunities, challenges and other regulatory needs to support the implementation of programs and projects using metered approaches to inform guidance beyond HOPPs. In addition, workshop attendees were invited to provide initial feedback on the normalized metered energy consumption guidance portion of the HOPPs ruling. Staff identified these key take-aways from the day-long discussion:

- Metered approaches may include engineering simulation, billing analysis, and experimental design. The academic work underpinning these methods is sound and appropriate for current applications.

- Additional analytic tools, advanced metering, and unconventional market strategies and programs to target different market sectors and end uses are becoming available. Mass-market software solutions can enable residential and commercial programs, but options are more limited for heterogeneous, unpredictable, and unique projects.

- Metered approaches allow for the ongoing assessment of long-term performance of energy efficiency programs and enable pay-for-performance program models. This in turn may allow for greater integration of energy efficiency benefits onto the grid. This is because metered results should provide a more accurate reflection of grid impacts, as

well as tracking of persistence, compared to an assumed estimated useful life with no true up.

- Meter data can be leveraged in different ways, depending on the target market. However, there is still need to account for unexpected events, which will affect M&V constructs differently; therefore M&V plans should be well designed to properly account for such effects. In addition, we need a process verify accuracy of the models and software being used to normalize the consumption reduction, especially in the case of proprietary tools.
- The availability of meter-based approaches does not eliminate the need for net-to-gross adjustments or attribution analysis. While many have called attention to the need for process simplification, there is a regulatory obligation to determine the benefits of the investment of ratepayer funds. While metered approaches and the potential to embed M&V in program design should facilitate the review and subsequent evaluation of savings claims, there is still a need to document interventions to determine what has been implemented and distinguish it from naturally occurring savings that would have occurred without the program's existence.

V. Staff's Proposed Framework

CPUC staff is presented with the challenging task to strike a reasonable balance among several statutory directives that could potentially apply to every type of energy upgrade in existing buildings regardless of its cause:

1. AB 802 seeks to ***establish clarity in reflecting all estimated energy savings or (measured) energy usage reductions*** in the circumstances under which financial incentives, rebates, technical assistance and support is offered in efficiency portfolios.
2. The statute states that programs shall include reductions from the adoption of a measure or installation required to bring exiting buildings into conformity with or to exceed Title 24.
3. The statute requires the CPUC to authorize the IOUs "to count all energy savings achieved through the authorized programs, ***unless determined otherwise***, toward overall energy efficiency goals."

Staff developed its proposed framework to conform to these statutory requirements. This framework proposes the conditions under which use of an existing conditions baseline is most likely to represent savings that are caused by utility programs, as distinct from when it is likely to credit utility programs with savings that would have occurred anyway, even in the absence of a program.

The general approach taken in this framework is that an existing conditions baseline is most likely to represent savings that are caused by utility programs when the programs induce a customer to make a building alteration or purchase equipment that saves energy. However, if

equipment has failed and cannot be repaired – leaving the customer with no other option but to replace the equipment with a current product available in the market – or when a customer has already planned a major alteration for which a permit is typically attained, then incremental energy efficiency is only achieved if the utility program has induced the customer to purchase higher efficiency equipment than the minimum efficiency level required by code, and a code baseline should be used to calculate these savings.

These distinctions are not always clear, and there are still other cases that are even less black-and-white. For instance, it makes sense to apply an existing conditions baseline to a whole building retrofit, even if some of the individual measures included in the retrofit are burned out, so technically code baseline would be more appropriate for those specific measures.

To address these different scenarios, staff's proposal is divided into program-level recommendations and measure-level recommendations. In both cases, a consistent theme is the importance of program influence, since absent this focus the vast majority of the savings in a below-code environment could easily become double-counted free ridership, which will do nothing to reduce energy demand and meet our GHG reduction targets, while spending unjustified additional ratepayer funds.

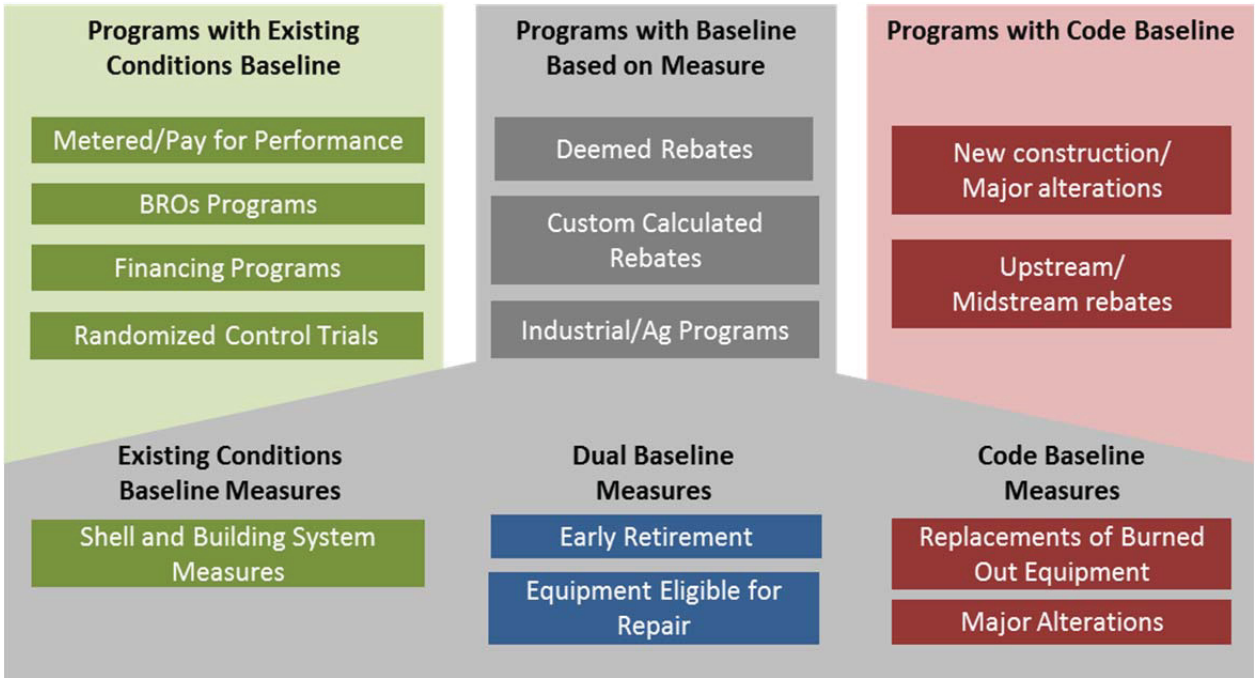
Finally, we note that:

1. These recommendations reflect our current perspective on assigning baseline, and many uncertainties remain for specific cases within each of these categories. Targeting truly stranded potential and implementing this new definition of energy efficiency will require an active effort from the program administrators and close monitoring by Commission staff and stakeholders, and the policy will likely need to evolve as more information is obtained.

2. The recommended savings baseline treatments discussed in this framework represent first-year savings for the purposes of utility claims towards their savings goals. Our recommendation for estimating lifecycle savings are provided in Section V.C.3.

The following figure illustrates staff's recommended approach to baseline.

Figure 3: Proposed Baseline Framework



A. Program Level Recommendations

Staff program level recommendations are divided into types of programs for which an existing conditions baseline is appropriate, types of programs for which a code/standard practice baseline is appropriate, and types of programs in which the determination should be made on a case-by-case basis. These recommendations are generally based on the methodology outlined previously in the HOPPs ruling.

1. **Types of Programs for Which Existing Conditions Baseline is Appropriate**

   a. **Pre-post audits and retrofits using normalized metered energy consumption:** Programs that apply the framework for normalized metered energy consumption, as defined in the HOPPs ruling,[21] are appropriate for existing conditions baseline. These projects are expected to link some portion of the incentive payments to the energy savings achievement, which engages the customer in an active role in the performance of the project and requires accountability of the implementer to deliver and verify. Staff recommends an expanded application of the HOPPs framework beyond 10% of the portfolio.

      As the HOPPs ruling is only beginning to be implemented, staff has not learned of any changes needed at this time, and recommends that the guidelines for metered approaches continue to be implemented as they were articulated in the HOPPs ruling.

   b. **Behavioral, Retrocommissioning, and Operational programs (BROs):** The BROs programs were specifically identified in AB 802. Existing conditions baseline will apply, in the case of retrocommissioning and operational measures, where a commitment has been made by the customer to ongoing training and maintenance plans.

      Staff recommends the following HOPPs rule clarifications:

      - **Baseline adjustment for regular maintenance** is not necessary when the customer commits to a three year maintenance plan and training.

      - **Behavioral, retrocommissioning (RCx) and operational expected useful life (EUL):** the HOPPs ruling adopted a 1 year EUL for lifecycle savings for these measures. We understand that EUL for RCx may be longer than the proposed year, but we have no data to support it. In addition there is currently no clear distinction between RCx and maintenance measures; these measures are classified solely based on the measure description by the PAs, which can be superficial and inconsistent. This lack of clarity and uniformity in measure description has been a challenge for the review of custom projects. This discussion is ongoing as part of our ex-ante review process. We recommend retaining a single year "lifetime" for these adjustments in energy use, while encouraging program designs that "renew" each year's commitment and could offer some kind of annual pay-for-performance motivation to assure savings persist.

[21] http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M157/K362/157362236.PDF

c. **Programs that use experimental design or randomized control trials:** While behavioral programs are currently the most widely known application of experimental design, randomized control trials can used with a number of different types of program designs to evaluate specific program influence. As with a scientific experiment, randomized control trials identifies a "control group" of customers with similar characteristics to the customers receiving program treatment, to compare metered usage over a given period of time. This enables the evaluators to determine program influence and isolate other factors that might affect energy use, such as the weather and economy. Programs with experimental design may use deemed savings estimates for the upfront incentives, or a hybrid with regression or simulation to estimate savings, but includes a randomized control trial to track influence of the intervention.

d. **Financing programs**: Staff anticipates that with the new financing pilots, the majority of the portfolio financing programs may be leveraging private capital with a much smaller portion of ratepayer dollars. Funding support varies by customer class, but may include traditional incentives or rebates, alongside or replaced by funds used as "credit support" for the finance risk taken on by lenders. In the latter case, credit support funds may be utilized to offset loan defaults or returned unused to an account naming ratepayers as beneficiaries. Some finance observers are eager to see if access to external project capital will enable deeper retrofits than traditional rebate programs. For these reasons, staff recommends that savings estimates for finance programs be based on existing conditions baseline.[22]

2. Types of Programs for Which Code or Standard Practice Baseline is Appropriate

a. **Upstream/midstream rebate programs:** Upstream and midstream programs provide rebates to manufacturers and retailers to encourage them to produce and sell high efficiency equipment.[23] Since the customer that purchases equipment through these programs has already decided to replace their old equipment, the program induced savings are limited to the difference between the options of equipment available for purchase. The customer can only replace their existing equipment with new equipment that meets the current codes and standards; thus, the code should remain the appropriate baseline.

[22] Staff notes that for many reasons savings associated with financing programs are different than traditional rebate programs. To address this, the CPUC may wish to scope into a future proceeding the development of separate goals and a separate component of the shareholder incentive mechanism to account for and incent utility financing program savings.

[23] Upstream rebates are directed toward manufacturers and retailers, in contrast to the more common downstream incentives, which are provided directly to customers as rebates.

b. New construction and major alterations /renovations: Besides providing incentives for new construction projects to exceed code, the current Savings By Design program also provides incentives to existing buildings for major renovation and rebuilding projects. These projects trigger code requirements and require permits, so the energy savings to code are already required to occur. If we were to allow the PAs to provide rebates and claim savings for major renovations already occurring throughout the economy, there could be unintended consequences of diverting ratepayer funds from bolstering truly incremental savings opportunities to subsidizing the cost of construction and renovation projects that will occur regardless (and explicitly whose construction trends already have been accounted for in the state's demand forecast and the associated energy procurement and reliability planning.[24]

Defining major renovations, however, presents a significant challenge for determining appropriate baseline. The Savings by Design program defines new construction as a project that involves complete removal, redesign, and replacement of the energy consuming systems of a building or a process that will certainly involve permitting and code compliance.

However, the most common form of renovations are commercial renovations for replacement tenants, which commonly involve a partial removal and replacement of energy consuming systems—namely lighting, but may include the alteration of other energy consuming systems. Any building alterations that replace energy consuming systems require permits and must comply with building code,[25] for which the recent C&S program impact evaluations found to have high compliance for interior lighting, as discussed in Section IV.C.

[24] Savings By Design Program Manual, http://www.savingsbydesign.com/book/savings-design-online-program-handbook, defines new construction as:

- New building projects wherein no structure or site footprint presently exists
- Addition or expansion of an existing building or site footprint
- Addition of new load, as in the example of an existing site adding a new process
- Construction that involves complete removal, redesign, and replacement of the energy consuming systems of a building or process
- Projects that require design and selection of new systems based upon the needs of new or modified space function(s)
- Major tenant improvements that add new load

[25] Title 24 Compliance Manuals can be viewed at http://www.energy.ca.gov/title24/2013standards/, and standards specific to building alterations are defined in the 2013 Building Energy Efficiency Standard Section 141.0-141.1 at http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF-REV2.pdf,

The problem to resolve is how to identify or target energy efficiency upgrades in major renovation and alteration projects that were not already planned to occur already. Otherwise, every alteration planned in every building, which must already comply with code, would qualify for incentives for simply following the law. Ideally, program implementers would simply self-report when they convince a customer to adopt a new alteration. However, the financial reward for misrepresenting customer intent is potentially so great that self-reporting would be unreliable. Commission staff does not have a straightforward recommendation to solve this problem. **We recommend that the following customer segments apply code baseline** and not use existing conditions as baseline, **unless they can meet one of the qualifying requirements** that follow below:

Customer segments where code baseline would apply:

- **New tenant retail:** Retail spaces are typically gutted and renovated as commercial tenants turn over.
- **Chain commercial:** Chain retail, with 5 for or more locations usually perform regularly scheduled capital upgrades, for which they use standardized interior designs.
- **Office space:** Maintenance of office space can widely vary. "Class A," office space is kept maintained and update; however office space classes are a term of art rather than a binding classification.

Since the quality of retail and office space and vary significantly the case that below-code savings for retrofits and maintenance is stranded will depend on meeting one of the following qualifications:

Qualifying requirements for exceptions

- **Documentation of program influence:** the program can provide documentation—i.e., project design documents -- that show that the project was originally not going to include energy system replacements, and the retrofit was influenced by the program, or photographs that indicate that the building is outdated, or
- **Experimental design:** program uses experimental design to demonstrate program influence, or
- **Hard to reach market:** the project occurs in a hard to reach market.[26]

[26] Hard to Reach Market is defined in the Energy Efficiency Policy Manual, APPENDIX B Glossary, http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/EEPolicyManualV5forPDF.pdf It can be summarized as "those customers who do not have easy access to program information or generally do not participate in energy efficiency programs due to a

Footnote continued on next page

3. Types of Programs for Which Baseline Should be Determined on a Case-By-Case Basis

For the following programs, the appropriate baseline should be determined by the measures installed; or by Industrial Standard Practice for processes in the Agricultural and Industrial programs.

a. Deemed rebate programs: For programs providing deemed rebates for individual measures, the baseline will depend on characteristics of the measure, and what caused the customer to replace the measure. Section V.B., entitled "Measure Level Recommendations," defines how different types of measures should be treated.

b. Commercial custom projects with calculated savings estimates: The PAs are looking to develop comprehensive whole building programs for the commercial sector as well, and have indicated that use of normalized metered energy consumption methods may not be appropriate for all types of projects. As a custom calculated project uses savings estimates from building simulations as the basis for incentive payments, the appropriate baseline should account for the factors by which specific measures are applied. Building shell and system retrofits and repair eligible equipment, listed in Tables 1 and 2, are changes made to the actual building, for which existing conditions baseline is appropriate. However, if the project includes equipment that is replaced when it fails, the project should account for appropriate baseline for the particular equipment, as further discussed below.

c. Industrial programs: Industrial customers take advantage of a variety of programs, including lighting, retrocommissioning, and finance programs, which are addressed above. In the case of industrial programs, the utilities already implement retrocommissioning programs that use existing conditions as the baseline for all projects. Staff sees opportunity for greater savings from industrial retrocommissioning programs that also include operations and maintenance improvements. These programs could be presented as AB802 existing baseline projects, possibly using a strategic energy management design.[27]

However, staff recommends that industrial custom projects should not use existing baselines as an across-the-board rule.

---

language, income, housing type, geographic, or home ownership (split incentives) barrier." Hard to reach business customers also include factors such as business size and lease (split incentive) barriers.

[27] Strategic Energy Management (SEM) is a method of identifying, claiming and tracking savings for operations and maintenance and retrocommissioning activities. It also supports development of capital projects with large energy savings. SEM is delivered through a program that provides audits, extended technical support, and assistance with goal setting, tracking of activities and energy savings, and long range planning. The PAs have been directed to carry out strategic energy management-type programs in the original Strategic Plan and subsequent Commission decisions.

Most capital projects are planned by the facility itself with a lead time that can range from one to five or more years. Industrial projects are complicated – changes in equipment can result in impacts to production and product quality and equipment upgrades are typically driven by changes in the industry and market forces. Consequently, rather than inducing industrial customers to initiate projects they otherwise wouldn't perform, custom industrial energy efficiency projects typically involve the use of program incentives to influence higher efficiency in projects already being carried out by industrial customers.

Therefore, staff sees little benefit in offering additional incentives to comply with code or to meet industry standard practices. Industry Standard Practice is the product of a market study, not a code or standard, and indicates the prevailing common practice equipment that is purchased in a defined market segment.[28] Industrial custom projects are not typically passed over due to lack of customer knowledge, funding, or the impact of stringent code requirements. They are clearly not a comparable, industrial version of the stranded savings in existing buildings identified in AB 802. Applying existing conditions baseline to custom projects would in most cases simply exaggerate the savings resulting from a pre-planned project and provide ratepayer funds to industries for projects they often need to undertake to bring their operations up to standard practice and remain competitive in their respective market segments.

d. Agricultural programs: Although there are retrocommissioning opportunities in the agriculture sector that could be treated as part of an AB 802 program, there are also larger projects that have traditionally been claimed as custom projects (e.g., pump replacements and retrofits). Staff recommends that large custom agricultural projects remain subject to the current baseline rules but invites comments on

[28] The CPUC Energy Efficiency Branch's ISP guidance document and links to studies are available at http://www.cpuc.ca.gov/General.aspx?id=4133. "Common practice" or "standard practice" is used for baselines in jurisdictions across the country. Industry standard practice studies are carried out here by the PAs. *See*, *e.g.,* http://www.calmac.org/warn_dload.asp?e=0&id=3126 (Measure, Application, Segment, Industry (MASI) : Wastewater Treatment Facilities). A standard practice inquiry may also be carried out with respect to an individual customer. *See*, *e.g.*, Uniform Methods Project, Chapter 23: Estimating Net Savings: Common Practices, section 3.3, available at http://www.energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf; Comments on UMP Chapter 23, Section 3.3, available at https://ump.pnnl.gov/printthread.php?t=5256&pp=1000&page=1; U.S. EPA, Draft Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency (EE), available at https://www.epa.gov/sites/production/files/2015-08/documents/cpp_emv_guidance_for_demand-side_ee_-_080315.pdf. Without ISP/common practice applicability, there would be no studies to determine whether measures should be sunsetted completely or partially or a basis for capturing additional savings in individual projects.

exceptions to this rule for measures or project types to which existing baseline calculations should apply and whether normalized metered data could be used to calculate savings.

B. Measure Level Recommendations

1. Types of Measures for Which Existing Baseline is Appropriate

a. Shell and building system measures: Many energy efficiency measures do not burn out, or if they do, the building can function without them. Thus, these measures often are not installed or replaced unless there is a major building renovation that requires permits and triggers code compliance.

Table 1: Shell and Building System Measures

Measure	End Use	Sector
Insulation	Building Envelope	Res/Com
Window Film	Building Envelope	Res/Com
Duct Sealing/Repair	HVAC	Res/Com
Ventilation	HVAC	Res/Com
HVAC Controls	HVAC	Res/Com
HVAC Quality Maintenance	HVAC	Res/Com
Energy Management Systems	HVAC	Com
Lighting Fixtures*	Indoor/Outdoor Lighting	Res/Com
Lighting Controls (occupancy, daylight, etc.)	Indoor/Outdoor Lighting	Res/Com
Add On Controllers, VSDs, Doors, ASH, etc.	Refrigeration	Com
Refrigeration Casework	Commercial Refrigeration	Com
Water Fixture Replacements	Service Hot Water	Res/Com
Distribution (Insulation)	Service Hot Water	Res/Com
Boiler Controls	Service Hot Water	Res/Com
Recirculation Pumps	Service Hot Water/Recreation	Res/Com
Pool Covers**	Recreation	Res/Com

*Lighting fixtures are discussed further in Section VI.B.3 below.
**While pool covers are not a building system or shell measure, they share the common characteristic that the energy consuming system, the pool, does not require the pool cover in order to operate.

These measures are appropriate for the application of an existing conditions baseline, though staff notes that the complexity of most of these measures make it very difficult to reliably estimate their savings, and they lend themselves to NMEC approaches. Light fixtures are also an unusual case that is further considered in Section VI.B.3 below.

b. Repair-eligible equipment: Certain types of equipment are reparable far beyond their expected useful lives, which represents a market barrier to replacing outdated, inefficient equipment with high-efficiency equipment. In their Technical Analysis, Navigant identified a list of equipment where saturation studies indicate a significant percentage remains in use well past its expected useful life. The following list includes this "repair-eligible equipment," though this list may not be exhaustive.

Table 2: Repair Eligible Equipment

Measure	End Use	Sector
Split/Package Air Conditioner	HVAC	Res/Com
Split/Package Heat Pump	HVAC	Res/Com
Furnace	HVAC	Res/Com
Chillers	Commercial Refrigeration	Com
Boilers	Process/Service Hot water	Com

"Repair-eligible" equipment may be reparable or may in fact be completely inoperable and require a replacement. This presents a challenge to implementation of this policy: if we allow existing conditions baseline for all installations of each these measure types, even if they are burned out and unable to be repaired, the free-ridership will significantly increase and net-to-gross ratios for projects pursuing this equipment will significantly decrease. This would lead to overstating portfolio net savings and reducing portfolio cost-effectiveness.

For this reason, staff recommends that savings claims for burned-out or highly degraded "repair-eligible" equipment should include documentation to demonstrate that the individual equipment being replaced *could* otherwise be repaired (i.e., what component broke and how the equipment could be repaired), and that the cost of repair would have been less than 50% of the replacement cost. For equipment to be considered reparable, the relative cost needs to make the repair a reasonable option. Further discussion is necessary to determine what documentation provides sufficient evidence of reparability.

2. Measures for Which Code or Standard Practice Baseline is Appropriate

a. Single measure rebates for equipment replacements with measurable EUL: Rebate programs that target equipment with stable EULs is generally replaced on burnout with measurable frequency, and is subject to Title 20 and/or federal appliance standards. To give credit for savings up to code for these activities would incent nearly 100% free-ridership for the savings up to code and would definitely result in double counting of the savings toward procurement planning and GHG targets. The CPUC's baseline policy prior to AB 802 was based on the type of replacement:

- **Replace on burnout (ROB) and normal replacement:** When a customer is already in the market to replace equipment, whether it is because the equipment failed or because they are just looking to replace their current equipment, the baseline is based on the existing code or standard for the equipment.

- **New construction:** This category includes major renovations, and applies code baselines for replacement.

- **Early retirement:** When the program induces the customer to replace functioning inefficient equipment, current policy applies a dual baseline treatment. To claim early retirement, an implementer must submit a "preponderance of evidence" to demonstrate that savings over pre-existing equipment for the remaining useful life (RUL) of the equipment being replaced, then savings above code-level for the rest of the EUL. Cost used is the full installed cost minus the net-present-value (discounted) full installed cost of the code-level unit. Program implementers claim that the requirements for claiming early retirement savings are so onerous that they often do not attempt to do so, although significant portions of recent utility claims have used early retirement treatment.

Staff recommends that savings claims be based on these three categories for individual downstream measures. However, staff recommends that the CPUC further clarify the "preponderance of evidence" needed to demonstrate that programs have induced early retirement.

Table 3: Equipment with Measurable EUL

Measure	End Use	Sector
Refrigeration Chillers, Compressors, Condensers, etc.	Commercial Refrigeration	Com
Cooking Equipment	Food Service Equipment	Com
Furnace/Heating equipment	HVAC	Res/Com
Lamps (without fixture or ballast change outs)	Indoor/Outdoor Lighting	Res/Com
Dishwasher	Plug Loads & Appliances	Res
Laundry	Plug Loads & Appliances	Res/Com
Refrigerator (appliance)	Plug Loads & Appliances	Res/Com
PC/Monitors	Plug Loads & Appliances	Res/Com
Smart Strips	Plug Loads & Appliances	Res/Com
Office Equipment	Plug Loads & Appliances	Com
Pool Pumps	Recreation	Res/Com
Pool Heaters	Recreation	Res/Com
Water Heaters	Service Hot Water	Res/Com

3. Measures for Which the Appropriate Baseline Depends on Program Design

There are two measure groups – light fixtures and HVAC equipment—that must receive closer attention. Assigning baseline for these end uses is particularly challenging due to the significant portion of energy use and efficiency potential they represent, the range of conditions by which they get replaced, and the associated measures that may or may not be implemented along with them. These measures will be included in different types of programs, or may stand alone as deemed measures. The direction in this section reiterates the direction above, clarifying how these proposed market rules would integrate for these measures.

a. HVAC Equipment Replacement: Typically, the decision to replace or repair heating or air conditioning equipment occurs on failure, and because heating and air conditioning equipment are integral to a functioning building, the decision is made in a small window of time. Based on saturation survey results, the extent to which HVAC equipment is repaired versus replaced is dependent on the type of equipment. For instance, approximately 25% of air conditioners currently in service are past their EULs (some of which are statistically expected based on the construction of EULs), whereas 75% of boilers currently in service are past their EULs.

However, staff recognizes that the efficiency of heating and air conditioning equipment is highly dependent on the quality of its installation. An equipment replacement that poorly sizes the unit, does not re-seal ducts, or fails to take other retrocommissioning / building system integration actions represents a missed opportunity to capture deeper savings. The Codes and Standards Impact Evaluation documents low permitting and compliance rates for HVAC replacement, indicating that Title 24 for HVAC systems has not been very successful in existing buildings.

Consequently, staff recommends that the baseline for HVAC depends on the type of program delivery, as has been described in the previous sections. For a basic HVAC replacement for burned-equipment that pays incentives on deemed or calculated savings estimates, without comprehensive retrofits, and consumption reduction approaches, a code-minimum baseline is appropriate for determining program-induced savings. Under these conditions, the program implementer will only cause the additional savings that are above and beyond what they were required to do under code.

Staff recommends that an existing conditions baseline be used in a comprehensive retrofit, provided that there is proof of a permit being issued and closed out. Comprehensive retrofit programs could include:

- Repair eligible equipment replacements, in which functioning or broken HVAC equipment can be replaced, or

- Metered approaches that measure the actual consumption reduction, with either experimental design or pay for performance, or
- HVAC replacements performed through a financing program with no utility rebate, in conjunction with our recommendation that the CPUC establish separate savings goals for financing programs.

b. Light fixtures and ballasts: Light fixtures are frequently replaced during renovation and building alterations, and the fixtures must comply with lighting standards.[29] The C&S Impact Evaluation discussed in Section IV.C found that lighting retrofits have realized 108% of the projected savings. This natural turnover represents many millions in investments and 250 GWh per year of savings that has already been accounted for in the demand forecast and toward our GHG targets. However, light fixtures rarely "burn out," so outdated lighting systems in old buildings that do not get renovated are an important source of stranded potential, estimated at around 50-75GWh per year in Navigant's technical analysis.[30]

How do we target the stranded potential while limiting the amount of double counted savings that gets captured? Practically speaking, a certain degree of free-ridership and double counting will be unavoidable, but lighting retrofits may result in as much as 90% or more free-ridership, based on the findings of the C&S Impact Evaluations. Commission staff proposes that lighting retrofits follow the alterations guidance in Section V.A.2.c (retrofits in new commercial tenants, chain retail and Class A office space should be treated like new construction and use code baseline). These categories may not be sufficient to limit the impact of double counting, and may need to be further disaggregated. We invite comments from parties on how to resolve this challenge.

C. Recommendations for Counting Savings

In workshop discussions and informal comments, parties have urged the CPUC to de-emphasize attribution of savings, because it does not serve the goal of meeting the customer needs, and can limit the amount of projects that may be approved. However, as noted earlier in the Challenges and Implications section, if the CPUC does not account for attribution when applying existing conditions baseline, efficiency programs may claim more savings than before AB 802, but may be actually accomplishing less real, additional reduction in demand – and therefore less GHG reductions – than in the past. Businesses implementing energy efficiency

[29] Lighting standards defined in Section 140.6 and 141.0 of 2013 Building Energy Efficiency Standards, http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF-REV2.pdf

[30] Stranded and double-counted savings results can be found on pages 42-49 of the Technical Analysis.

programs will, as a general market reality, pursue the most easily and cost-efficiently achieved energy efficiency activities, which are by and large the projects that would happen regardless of whether the program was in place.

For this reason, accounting for program attribution remains a critical element to effectively implementing AB 802, regardless of whether the savings are achieved through deemed, metered, or calculated engineering approaches. This new definition of energy efficiency makes it even more important – not less so – that the PA's goals be aligned with directing funds toward incremental savings, because the potential for free-ridership and double counting will be much greater with existing conditions baseline.

1. Set goals as net of free ridership (after factoring in spillover)

The CPUC currently sets energy savings goals for the IOU based on the gross savings—meaning that the saving goals and measure of IOU program savings to achieve this goal do not account for program influence and remove free-ridership for the goals achievement. Goals were originally set as net of free-ridership when adopted in 2004, but D.08-07-047 shifted goals to gross in 2008 to reflect the savings assumptions in Secret Surplus Study, which goals were based on at the time.[31]

During the January 2016 workshops, IOU staff suggested that the savings for which the customer gets credit does not need to be the same value as the savings for which the PA is credited. Staff does not disagree with this point. Our recommendations are focused on the savings that count toward IOU program goals, which staff recommend should only include savings that result from the IOU programs (including spillover credit).[32] Program Administrators can design programs and "credit" customers for savings in whatever manner they find most advantageous for the customer experience, provided their savings goals are achieved and their portfolios are cost effective.

Adopting net goals is a straightforward policy change: the Potential and Goals model already calculates a net savings forecast, which is used for the demand forecast, and the impact evaluations already calculate total portfolio savings on both a net and gross basis. To implement goals on a net basis would simply mean that the next set of goals adopted would be based on the net value in the model and that IOU's achievement of goals would no longer include freeridership. Customer programs may give credit to the customer for their gross savings, and the PAs would continue to submit both gross and

[31] The policy history of energy efficiency goals can be found at http://www.cpuc.ca.gov/General.aspx?id=2013

[32] The spillover effect is included in the cost-effectiveness methodology as a 5% adder, though additional research to better understand spillover is warranted.

net savings claims, but the goals they pursue would be calculated as net of freeriders (including a spillover market adder).

The Efficiency Saving Performance Incentive (ESPI), cost-effectiveness calculator, and the Additional Achievable Energy Efficiency forecast already apply net savings, and goals achievement is the only aspect that is inconsistent with the rest of our policy framework.

Staff recognizes that the proposal to return to net savings as the basis for goals is likely to be controversial as this debate has been held multiple times in the past 10 years of energy efficiency policy.[33] The key reason to move away from net savings goals in D.08-07-047 was based on the desire to reflect the impact of total or gross savings on the grid and support the budding working group with the CEC on demand forecasting "solve the crucial interagency need for a metric appropriate to load forecasts, associated emission reduction baselines, and economically efficient procurement plans."[34] **As it turned out though, the CEC needed to use *net* IOU program savings for their forecasts, so this purpose did not actually apply.**

Historically, evaluation adjustments for program influence have also been erroneously targeted as a key reason for missing the goals, when in reality multiple factors can lead to that outcome, and program influence is one of the things that can be controlled by effective program design. Parties' arguments that evaluation methods used for net adjustments savings claims are problematic have typically revolves around concern that a customers' ability to assess the degree to which the program influenced their decision is limited, which may be true in certain situations and is why net to gross methods utilize multiple strategies including market trend analysis to determine free ridership.

Meanwhile, the adjustment to net savings claims based on evaluations has historically been minor, because the IOUs' savings claims already include their estimated net-to-gross ratios.[35] In addition, staff notes that beginning in 2013, the Commission has also directed the IOUs to include spillover effects ("positive" attribution credits) in their net savings estimates. These net savings are is even more challenging to measure reliably than free ridership, but this policy has met with little resistance from parties.

---

[33] The History of Goals can be viewed at http://www.cpuc.ca.gov/General.aspx?id=2013

[34] D.08-07-047, page 13.

[35] Recent adjustments to net savings claims based on evaluation results is are illustrated in Figure J-2 of Appendix J to the 2010-12 Energy Efficiency Evaluation report (http://www.cpuc.ca.gov/General.aspx?id=6391). This diagram illustrates estimates of program influence that are already removed from portfolio net savings estimates (column d), and the fact that the incremental adjustment for program influence that is assessed in the final evaluations only identified a small additional change from the IOUs' ex ante estimates, as reflected by column (e).

Staff believes that free ridership and spillover assumptions should be both included in programs designs and evaluations, and that differences between ex ante and ex post values are first and foremost important tools for informing program design modifications. Staff also notes that Program Administrators have just as much opportunity to reduce free ridership in the course of implementation (compared to the ex ante estimate) as they do to worsen it, as this parameter is primarily dependent on approaches to customer targeting. Programs may target customers by seeking out and soliciting new projects that push the customer to adopt energy efficiency measures that they were not already planning on, or they may simply "harvest" projects that have already been planned.

Staff conversations with Program Administrators, and responses to questions on this topic from Program Administrator staff in the baseline workshops suggest that net savings impacts on ESPI payments and portfolio cost-effectiveness are not prioritized compared with achieving (gross) portfolio savings goals, which suggests to staff that a clearer signal is needed to encourage Program Administrators to maximize net portfolio impacts. Now that simply complying with code can qualify a customer to receive incentives, staff believes that it is even more critical that goals discourage free ridership.

2. Use alternate methods to account for attribution where possible

The best method to account for attribution is dependent upon the intervention that is trying to be gauged. The commonly used methods or principles, for which no viable alternative have emerged, are those identified in the California Energy Efficiency Evaluation Framework.[36] The key to determining the appropriate attribution accounting method is a program logic model that clearly identifies the market barrier the program is trying to address, and the intended effect or influence of the intervention. Parties have raised possibilities of the application of alternate approaches or modifications to gauging attribution, such as “dynamic baseline.” Staff recommends that parties submit more research to describe these approaches, with examples of where they have been successfully used.

Regardless of the method, documentation is critical at the point of implementation. Like the concepts in the HOPPs framework, program implementers should consider

[36] Uniform Methods Protocols released by DOE build upon the California Framework and Protocols by offering additional measure and topic specific protocols. The following link is to the Net Analysis Protocol http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf

embedding tracking and measurement into program design and not wait for evaluation professionals and regulatory bodies to determine net to gross impacts. The challenges of collecting information after the fact and the loss of actionable information from the trend over time are solvable problems, and staff strongly recommends that PAs incorporate evaluation methods into their implementation plans as part of the program design.

3. Recommendations for Estimation of Lifecycle Impacts

The recommendations included in staff's framework address baseline in the context of the first years savings credit that utilities will claim towards their portfolio goals, which are first year savings goals. AB 802 was silent on how the CPUC is to address the lifecycle impacts of this new existing baseline policy, yet staff believes that the policy on estimating lifecycle impacts is critically important since it is used to estimate the portfolio-delivered greenhouse gas reductions, future peak demand reductions in the period in which grid planners are making infrastructure procurement decisions (i.e., five to ten years into the future), and cost effectiveness. Consequently, getting the policy on lifecycle impacts wrong could result in over- or under-estimating efficiency contributions to greenhouse gas reductions, miscalculations of the need for additional grid infrastructure (including infrastructure needed to achieve the state's renewable energy goals), or nonconformance with the CPUC's statutory obligation to authorize the utilities to procure all cost-effective energy efficiency resources.

As noted throughout this white paper and regardless of what initial policies are adopted by the CPUC, as the policy is implemented and more information is obtained on the types of projects and measures that program administrators target, the policy should evolve. Staff believes it unlikely, based on the history the evaluation results of these programs (including evaluations oversee by the utilities themselves, prior to 2006 when the CPUC delegated this responsibility to staff), that the new AB 802 programs will only target stranded equipment that would have otherwise remained in place for the entire useful life of the new equipment. This assumption simply does not conform with past experience, or the likelihood that a portion of this equipment would have become irreparable during the life of the new replacement equipment.

Consequently, staff offers the following recommendations for how lifecycle impacts could be estimated for the different categories of existing conditions baseline identified above in subsections A and B, until data is obtained from AB 802 program implementation that suggests adjustments to this initial approach.

In addition, to and incorporated into these program-and measure-specific recommendations, staff recommends that the 20-year cap on EUL be removed in cases where data supports longer EULs than 20 years.

a. Recommendations for Measures that Apply Existing Conditions Baseline

Calculation of life-cycle savings primarily depends on the type of measure installed. Certain measures may never be replaced or installed because the building will function normally with the inefficient equipment. But for equipment that will inevitably burn out and the building cannot operate normally without the equipment, then turn-over can be expected to occur and savings over the life of the equipment need to be adjusted to account for the counterfactual.

- **Shell and building system measures:** Since a building can operate without the installation of shell and building system measures, staff recommends that these measures receive existing conditions baseline across their full measure life.

- **Early Retirement:** Staff recommends that while existing conditions is used for first-year savings estimates of early retirement projects, dual baseline is necessary for calculating the lifecycle savings. Currently, all early retirement RULs are set at the default value of 1/3 EUL, which was developed approximately ten years ago based on an examination of various saturation studies (RASS, CLASS, CEUS, etc.) and persistence curves from EUL studies. Staff is not recommending any changes to the early retirement lifecycle impacts calculation at this time, but we recommend that as data is obtained to address the various data gaps identified in this proposal, RULs be adjusted from a default EUL value to reflect the actual persistence of various types of equipment.

- **Repair-eligible Equipment:** While these types of equipment are potentially reparable for extended periods of time, significant amounts of this equipment clearly do turn over (that is, not all of this equipment is still in place in perpetuity). As with early retirement, staff recommends that lifecycle savings for repair-eligible equipment initially be calculated using ½ EUL at existing conditions and ½ EUL at code baseline, and is adjusted as better, equipment-specific persistence information is obtained.

b. Recommendation for Programs that Apply Existing Conditions Baseline

The programs in Section V.A.1 present particular challenges for counting lifecycle savings, since the programs are primarily designed to encourage multiple measures, with savings counted at the meter. If the project includes a combination of long-lived measures and short-lived measures, it is not clear how to calculate the lifecycle savings for the total project.

- **Programs using normalized metered energy consumption:** Although savings claims and incentive payments with these programs are based on actual metered reductions in use, lifecycle savings will need to be estimated at the outset of the project based on the EUL of the project. If the project includes equipment measures – which are replaced on burnout, repair eligible or early retirement,

then the measures, then the lifecycle savings will be vastly overestimated without a dual baseline. However, if the project includes a combination of measures that include shell measures, then the project will either need to calculate a measure-based savings estimate for lifecycle savings or apply broad assumptions to the entirety of the project that will discount the lifecycle savings value for shell measures. Either method will discourage the future implementation of measured approaches. For these reasons, the CPUC needs further input on how to calculate the lifecycle savings with metered approaches. Until a better method is identified, staff recommends that lifecycle savings be calculated based on a dual baseline for projects that only include equipment replacement, and that projects that implement a combination of measures that include building systems and/or shell measures apply existing conditions baseline for the life of the project, based on a weighted average of the measures' EULs.

- **Behavioral, Retrocommissioning, and Operational programs (BROs):** Consistent with the HOPPs ruling, BRO programs should have a lifecycle savings EUL of one year which can county towards the IOUs' first-year savings goals each year the program is in place but for which lifecycle savings will not be calculated, until the persistence of these programs is better understood.

D. Proposed Guidance for Portfolio Development

1. Apply framework established for the HOPPs

AB 802 and SB 350 direct the CPUC to provide incentives for existing buildings to get to code considering normalized metered energy consumption, indicating that these methods should be the primary approach for energy efficiency in the future. The PAs need to plan for this transition, which is expected to begin on September 1, 2016. As defined in the previous section, the NMEC approaches are not effective for all types of energy efficiency activities, but they provide significant benefits to many types of activities over deemed methods; thus they should be used where possible.

2. PAs should propose strategies for each sector in the business plan filings

Staff proposes that the CPUC not establish specific requirements about portfolio composition by September 1; but rather that the PAs propose the changes to the portfolio composition to be included in their business plan filings. This will allow for a period of experimentation and learning before committing significant portions of the budget to a particular strategy. These proposals should explain how new programs will incorporate metered approaches into the portfolio as part of the larger business plan strategy.

E. Need for New Data Collection Efforts

The initiation of existing baseline programs will require new data collection efforts to understand the overall energy savings implications of new existing conditions programs.

1. PAs should collect data about equipment being replaced through programs.

First, implications specific to the measures that PAs are replacing are needed to understand net savings of new programs. In programs with code baselines, the principal item of data needed is the efficiency rating of the above code equipment that the participant was incented to install. For existing baseline programs, the baseline equipment and conditions must also be documented.

2. Aggregate population studies are also needed.

Second, studies of the population of existing buildings are needed to understand the aggregate potential for existing conditions programs. As noted earlier, and explained in more detail in Navigant Consulting's report in Appendix D, the degree to which certain kinds of equipment have been repaired rather than replaced is unknown. Estimates of non-compliance with the requirements of Title 24 Building Standards applicable to different existing building alteration types need to be better understood.

VI. Conclusion

This white paper is a launching point to frame the issues with implementing an existing conditions baseline, and not a draft decision. It raises a number of issues that are challenging to resolve. Most everything in building renovation requires permits and should comply with code; yet how do we define what will not occur, whether not initiated, or not brought onto the codes and standards system radar? Similarly, when is a building system repairable, or so far gone that the owner has no choice but to replace it with new (naturally higher efficiency) equipment?

Finally, when can substantial energy use be reduced from strategic energy management, controls feedback systems, and smart maintenance? When is this "normal" business operations, and when is it a special performance level to be financially rewarded with ratepayer incentives? We will need to explore several of these elements more in depth, ideally through comments to this white paper to inform implementation by September, but otherwise we will need to continue to consider them to refine implementation of AB 802 going forward. These issues include:

- A more robust definition of building alterations, and when Title 24 compliance can be reasonably expected to occur.

- What types of program designs can find and capture the buildings that are failing to renovate and upgrade their buildings, perhaps because of capital limitations or lack of technical knowledge?

- The best methods for determining whether the cost and specifics of a building alteration were caused by program influence or would have happened anyway?

- How to drive customers to maximize efficiency, and not simply meet code while collecting some ratepayer subsidy?

CPUC staff will need to closely follow the outcomes of the changes to baseline, and how they are impacting the market, once these programs are implemented.

Upon completion of this analysis, the CPUC will need to launch the next phase of the Potential & Goals update, in coordination with the CEC to integrate the AB 802 activities into the broader planning process to meet the requirement to double energy efficiency. The update will build upon the Technical Analysis developed by Navigant, and parties' comments and proposals for new approaches that can estimate goals from metered projects.

The CPUC may also reconsider how project cost is calculated for existing conditions baseline in the cost effectiveness calculator. Since it is currently based on the entire project cost rather than the incremental cost, as for code baseline, using an existing conditions baseline may cause measures to appear less cost effective than under a code baseline.

APPENDIX A:
AB 802 and SB 350 Excerpts on Efficiency Programs

Assembly Bill 802

381.2. (b) Recognizing the already underway 2015 commission work to adopt efficiency potential and goals, the Energy Commission work on its 2015 energy demand forecast, and the need to determine how to incorporate meter-based performance into determinations of goals, portfolio cost-effectiveness, and authorized budgets, the commission, in a separate or existing proceeding, shall, by September 1, 2016, authorize electrical corporations or gas corporations to provide financial incentives, rebates, technical assistance, and support to their customers to increase the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions, taking into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings. Those programs shall include energy usage reductions resulting from the adoption of a measure or installation of equipment required for modifications to existing buildings to bring them into conformity with, or exceed, the requirements of Title 24 of the California Code of Regulations, as well as operational, behavioral, and retrocommissioning activities reasonably expected to produce multiyear savings. Electrical corporations and gas corporations shall be permitted to recover in rates the reasonable costs of these programs. The commission shall authorize an electrical corporation and gas corporation to count all energy savings achieved through the authorized programs created by this subdivision, unless determined otherwise, toward overall energy efficiency goals or targets established by the commission. The commission may adjust the energy efficiency goals or targets of an electrical corporation and gas corporation to reflect this change in savings estimation consistent with this subdivision and subdivision (d).

(c) Effective January 1, 2016, electrical corporations and gas corporations are authorized to implement the provisions of subdivision (b) for high opportunity projects or programs. The commission shall provide expedited authorization of high opportunity projects and programs to apply the savings baseline provisions in subdivision (b).

(d) In furtherance of subdivision (b), the commission, in consultation with the Energy Commission, shall consider all of the following:

(1) The results of any interagency baseline assessment.

(2) Any available results from investor-owned utility baseline pilot studies ordered in D.14-10-046.

(3) Information necessary to ensure consistency with the energy forecast and planning functions of the Energy Commission and the Independent System Operator.

Senate Bill 350

399.4. (d) The commission, in a new or existing proceeding, shall review and update its policies governing energy efficiency programs funded by utility customers to facilitate achieving the targets established pursuant to subdivision (c) of Section 25310 of the Public Resources Code. In updating its policies, the commission shall, at a minimum, do all of the following:

(1) Authorize market transformation programs with appropriate levels of funding to achieve deeper energy efficiency savings.

(2) Authorize pay for performance programs that link incentives directly to measured energy savings. As part of pay for performance programs authorized by the commission, customers should be reasonably compensated for developing and implementing an energy efficiency plan, with a portion of their incentive reserved pending post project measurement results.

(3) Authorize programs to achieve deeper savings through operational, behavioral, and retrocommissioning activities.

(4) Ensure that customers have certainty in the values and methodology used to determine energy efficiency incentives by basing the amount of any incentives provided by gas and electrical corporations on the values and methodology contained in the executed customer agreement. Incentive payments shall be based on measured results.

APPENDIX B:
CEC Analysis of AB 802 Impacts of Codes and Standards
On IOU Programs and Demand Forecast

California Energy Commission

Energy Efficiency and the Demand Forecast

The Energy Commission has two distinct roles regarding energy efficiency. The first role is to help California *achieve all cost-effective energy efficiency* in buildings and industries through statewide policy setting, codes and standards, financial assistance and program advocacy. In this role the Energy Commission must do everything possible to increase the scale of energy efficiency *actions* needed in the market place to achieve the state's aggressive greenhouse gas emission reduction goals, consistent with SB 350 (de León, 2015) and AB 802 (Williams, 2015).

The second role the Energy Commission holds is statewide resource planning, where long- term demand forecasts incorporate expectations of future energy efficiency in buildings and industries to the extent possible. *Actual, realized savings are counted* in the demand forecast through adjustments to forecast inputs, through adjustments to raw model output, and finally by calibrating final model outputs for historical years to actual energy consumption. The demand forecast is by nature not necessarily precise for energy savings resulting from specific measures, programs, or actions. But on average and overall, the forecast is adept at defining trends in energy demands that must then be met with adequate resources.

The Energy Commission is committed to the successful implementation of AB 802 and SB 350, as intended by the legislature. In its energy efficiency policy role, the Energy Commission believes that it is critical for the state's efficiency programs to be dramatically changed to be more successful in achieving larger cumulative savings that persist over time. The primary intent of AB 802 and SB 350 is to compel the energy agencies to initiate new approaches and program pathways to achieve energy savings that market realities now leave untouched. From the perspective of its resource planning role, the Energy Commission will continue to generate demand scenarios of probable energy consumption for the planning horizon.

With better information on efficiency program characteristics and measured results, the demand forecast will be able to project independently both savings from future program participation and those from naturally occurring projects, including savings from regular equipment turnover that is influenced by appliance and building standards. The edges of savings attribution wedges will never be precise, but more complete data collection will enable adequate portrayal of overall trends within the forecast, which can be improved over time. Given this reality, the Energy Commission is less concerned with the uncertainty inherent in savings attribution from utility programs. Importantly, expanded data collection, augmented with normalized metered energy consumption analytics, will more accurately capture market realities and help reduce uncertainty associated with additional energy efficiency. These directives of AB 802 and SB 350 are consistent with the Energy Commission's Existing Buildings Energy Efficiency Action Plan.

A true change in the scale of achieved energy savings will not appear in the forecasted demand trend in advance of bold actions to pursue these savings. The estimates derived by the Public

Utilities Commission and the Energy Commission for energy efficiency potential and the subset identified as Additional Achievable Energy Efficiency (AAEE) are constrained by what has been deemed to be cost-effective in the past, and the scope and veracity of the inputs into potential models. The Energy Commission understands that both baseline demand forecasts and AAEE projections will initially miss structural changes to markets that were not anticipated or are too uncertain to predict yet. There needs to be some ability to characterize and launch market changes before they can be included in the forecast. However, our current inability to precisely count energy savings achieved should not become the reason to preclude programs from achieving previously stranded savings.

Thus, promoting innovative efficiency programs should be separated from concerns about the uncertainty of realized savings incorporated into the demand forecast. In parallel, it is important to the Energy Commission to collect data on all aspects of energy markets, including the impacts of efficiency programs, to reduce such uncertainty. With proper data collection and enhanced modeling techniques, the net impacts of new programs using existing conditions baselines can be properly reflected in future demand forecasts and accompanying AAEE projections.

An Introduction to Energy Efficiency Standards

SB 350 (Statutes of 2015, De León) codifies into law Governor Brown's goal to double the energy efficiency savings in electricity and natural gas final end uses of retail customers by 2030. The legislation expands on the existing authority pursuant to AB 758 (Statutes of 2010, Skinner) for the Energy Commission to plan and implement a comprehensive program to achieve energy efficiency in existing buildings that will result in the doubling goal being met. It also directs the Energy Commission in consultation with the CPUC and POUs to set targets for energy efficiency and demand reduction that will accomplish the doubling goal, and approve targets established for IOUs and POUs for their needed contributions to the statewide targets. SB 350 also directs that the Energy Commission and CPUC to consider for the purpose of setting the targets, energy efficiency potential not restricted by previous levels of utility energy efficiency savings, and that the achievement of the targets be measured based on the overall reduction in metered electricity and natural gas assumption.

AB 802 (Statutes of 2015, Williams) likewise recognized the need for the Energy Commission to focus on meter-based energy savings, and directed the CPUC to increase the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions, taking into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings. The CPUC was directed to include energy usage reductions resulting from the adoption of a measure or installation of equipment required for modifications to existing buildings to bring them into conformity with, or exceed, the requirements of Title 24 of the California Code of Regulations, as well as operational, behavioral, and retro-commissioning activities reasonably expected to produce multiyear savings.

The direction in both bills is consistent with the Energy Commission's adopted Existing Buildings Energy Efficiency Action Plan that places emphasis on the establishment of performance-based incentives for the resource procurement of energy savings from the marketplace, promoting long-term engagement by consumers and encouraging innovative business approaches, through the pervasive use of analytics to drive targeted improvements. The Energy Commission believes that meeting the doubling goal will not be possible without moving to this broader, performance-based approach. The Energy Commission recognizes the need for a baseline for performance-based approaches to be the existing conditions prior to improvements in existing buildings, and that "above code" baselines used heretofore may preclude and/or delay energy savings from occurring rather than encouraging them, as needed to support accomplishment of the doubling goal.

The Energy Commission's 2013 Integrated Energy Policy Report noted that, "the state may need to modify its incentive mechanisms to provide value for both compliance with the standards and the total energy savings from upgrading inefficient equipment and building measures." In discussion it said,

> "One barrier to full investment in energy efficiency upgrades in existing buildings is the practice of viewing building energy efficiency standards requirements as a "bright line" threshold, below which no public incentives are made available. This can be dysfunctional in two ways: 1) failure to motivate the act of compliance such that many projects are completed without building permits and without code enforcement because the marketplace does not provide clear benefits for compliance; and 2) failure to achieve the savings that would occur from upgrading inefficient equipment and building materials because only the incremental improvement above the standards is eligible for incentives. These conditions lead to purposeful avoidance of building permits and standards compliance, and to decisions to postpone upgrade projects. This prolongs the wasteful energy impact of inefficient equipment and materials, and discourages participation in energy efficiency programs because program requirements are too high and incentives are too low."

A concern that complicates moving to an existing conditions baseline is the potential for "double counting" energy savings in demand forecasting. AB 802 recognizes this issue and calls for the Energy Commission to modify its demand forecast with appropriate savings from "existing conditions" programs. The Efficiency Division believes that endeavoring to achieve the doubling goal would be best served by the utilities estimating with greater accuracy the savings observed in program participant buildings with respect to existing conditions, providing the Energy Commission's demand forecasting staff with that information for incorporation into the forecast. Energy savings for non-participants in utility programs would use the more global approaches that are used to incorporate Standards savings estimates in the forecast. In this way demand forecasting staff would have the full information needed to minimize "double counting," and there would not be any artificial barrier to fully pursue the doubling goal that can result from a rigid above code baseline.

One way to accomplish these multiple goals is for the CPUC to require utilities or other program providers to establish "control groups" to help estimate the realized impacts of performance based incentive programs, the measured usage data and building/occupant characteristics defining these control groups must be shared with the Energy Commission in parallel with "existing baseline" program participant data. Eventually the demand forecast will be completely consistent with these control groups in terms of non-participant energy use expectations. Further, once the Energy Commission completes its planned data collection efforts to support the demand forecast and energy efficiency policy tracking, this data can itself be used to define, describe and quantify energy use expectations of specific control groups. This is consistent with the Existing Buildings Energy Efficiency Action Plan concept of "granular baselines", which the Energy Commission articulates in Strategy 2.1.9 (Page 60 of the EBEE Action Plan).

Appliance Efficiency Standards in Existing Buildings

Both the federal government through statute and regulations adopted by the U.S. Department of Energy and the California Energy Commission adopt and put into effect appliance efficiency standards for a wide array of different types of appliances, including equipment that is permanently installed in buildings and equipment that is portable and is brought into buildings and plugged into electrical outlets. The Appliance Efficiency Standards are shown at http://www.energy.ca.gov/2015publications/CEC-400-2015-021/CEC-400-2015-021.pdf.

In general compliance with federal appliance standards is high since rules are nationwide, manufacturers have substantial liability for failure to comply, there is substantial policing within the industry itself, and there is limited opportunity for non-compliant products to be chosen over compliant products. California's state appliance efficiency standards (Sections 1601 – 1609 of Title 20, California Code of Regulations) require manufacturers to manufacture compliant appliances, and certify to the Energy Commission the tested efficiencies of their models. In addition, sellers of appliances throughout the state are required to sell only models that have been certified to the Commission that they comply with the standards. Given that there are products in the national market that don't comply with the California standards, and that not all sellers recognize their responsibility to sell in the state only models that comply; achieving high compliance with state appliance efficiency standards is more challenging. There are four other reasons why estimated savings based on test procedure results might be different than what is accomplished at the meter. First, test procedures are imperfect in estimating the actual energy use of an in-place appliance. Second, the quality of installation of permanently installed appliances can degrade, in some cases substantially, the energy savings that would be anticipated by best installation practices. Third, appliance usage can vary widely from the typical expected practice, resulting in different energy savings resulting from tested efficiency from one household to the next. Fourth, the energy efficiency of some appliances can deteriorate over time.

Building Efficiency Standards in Existing Buildings

The California Building Energy Efficiency Standards (Part 6 of Title 24, California Code of Regulations) apply to newly constructed buildings in their entirety, additions to existing buildings in their entirety, and to specific alterations to equipment and systems in existing buildings. The Building Standards provide both performance and prescriptive compliance approaches. The performance approach requires construction projects subject to building permits to meet an energy budget for the project allowing wide flexibility, limited only by the Standards approved energy calculation rules, for how that energy budget is met. The prescriptive approach requires projects, instead, to meet a "checklist" of energy efficiency measures with no flexibility outside of those specified measures. Performance approaches are widely accepted as the preferred manner to establish regulations, including building codes in particular. Prescriptive approaches can be easier to understand, responding to a "just tell me what I have to do" perspective of persons wanting for compliance simplicity. The Energy Commission is statutorily required to provide both performance and prescriptive approaches in the Building Standards.

The performance approach is believed to be used nearly all of the time for residential newly constructed buildings and additions, and roughly half of the time for nonresidential newly constructed buildings and additions. The prescriptive approach is used the rest of the time for these construction projects, and the large majority of the time for alterations to existing residential and nonresidential projects.

Additions to existing buildings larger than 1,000 square feet commonly are required to meet all of the requirements for a newly constructed building. When using the performance approach additions projects can either meet the energy budget for the addition alone, or can make energy alterations to the existing building to achieve equivalent energy savings. Alterations to existing buildings are required to meet Standards, in order to take advantage of the opportunity created by the project to improve the energy efficiency of the building component or building system that is being altered. Alterations that require a building permit are an important opportunity in the life of existing buildings to make efficiency improvements at the point in time that work crews are already on the site and upgrades can be made at lowest cost.

For the 2013 Standards currently in effect, the prescriptive requirements for nonresidential and high-rise residential alterations are shown on pp. 203-209 (see http://www.energy.ca.gov/2012publications/CEC-400-2012-004/CEC-400-2012-004-CMF-REV2.pdf). Altered building envelopes are required to meet the insulation requirements specified for the altered roof, wall or floor; the window performance factors specified for the altered windows; and the cool roof performance factors specified for the altered roofs. Altered space conditioning systems or components are required to meet the performance factors specified for the altered systems/components. Altered lighting systems are required to meet the lighting power limits and lighting controls specified for the altered systems/equipment. Altered service water systems are required to meet the specified efficiency, performance and

insulation requirements for the altered systems/components. Information regarding how to comply with the requirements for alterations are described in the Nonresidential Compliance Manual (see http://www.energy.ca.gov/title24/2013standards/nonresidential_manual.html), as a separate section for each building system chapter of the manual. The *Energy Code Ace* website (see http://energycodeace.com/) developed and maintained by the IOUs provides useful guidance for how to comply with the nonresidential and high-rise residential alterations requirements.

The 2013 Standards prescriptive requirements for low-rise residential buildings alterations are shown on pp. 238-242 of the Standards. Similarly to the nonresidential and high-rise alterations requirements, alterations to the building envelope, space conditioning, water heating, and lighting systems/components are required to meet the specified performance factors, insulation, power limits and controls. Information regarding how to comply with the requirements for alterations is described in the Residential Compliance Manual in the Alterations Section (Section 9.6) (see http://www.energy.ca.gov/2013publications/CEC-400-2013-001/chapters/09_Additions_Alterations_and_Repairs.pdf). The *Energy Code Ace* website also provides useful guidance for how to comply with the residential alterations requirements.

Compliance with the Building Standards performance approach for newly constructed buildings has been found by EM&V studies to be high, generally over 100%. This is substantially due to strong voluntary compliance efforts by most production builders who have sophisticated technical support and systematic construction methods, and have "deep pocket" reasons to endeavor to avoid construction defect liability and litigation. Also, compliance with the performance approach for additions to existing buildings appears to be relatively high, as these multi-trade projects tend to involve similar support (including a general contractor and potentially an architect or engineer) and similar concerns about defect liability. General practice is for work on newly constructed buildings and additions to be conducted under a building permit, providing local building departments an opportunity to check for compliance.

Compliance for alterations can be more challenging with specialty contractors in charge of the work. Often these projects are done in a very cost-competitive environment driven by low cost bidding and needing to "get in and get out" as quickly as possible. Frequently, projects are replacing equipment that has failed, and there is a premium on restoring service as soon as possible. Standards requirements, including acceptance testing for nonresidential buildings and field verification for residential buildings that is focused on ensuring that quality work is done on these projects, call for demonstration of due diligence that can be at tension with project expediency goals. When these projects are conducted under building permits, building departments have an opportunity to check for compliance, but their limited resources to devote to these smaller projects can be strained, particularly where motivators for greater attention to voluntary compliance, such as may be the case for newly constructed buildings or additions, may be missing.

Beyond the compliance realities described above, a separate problem arises when alterations to existing buildings are done without compliance with contractor licensure, building code and local jurisdiction laws that require projects to be completed under building permits. This practice enables building owners and contractors to avoid building department review of compliance of the projects with all aspects of the building code, including health and safety and energy requirements, as well as other legal requirements such as work compensation, bonding, and business and contractor licensing.

The prevalence of the failure to pull permits appears to vary depending on the potential for liability associated with the practice. Given that this problem for the most part does not exist for newly constructed buildings, it appears that for larger economic projects, such as residential subdivisions and major alterations to nonresidential buildings, the problem is less common. These projects also are commonly overseen by a professional general contractor with more to lose by taking risks related to liability and greater expertise to ensure quality work than is the case for individual homeowners. A study conducted by the University of California, Davis Western Cooling Efficiency Center entitled *"Contractors Walk on the Wild Side…Why?"* (see http://wcec.ucdavis.edu/wp-content/uploads/2013/07/Kristin-Heinemeier-ACEEE-2012.pdf) found that commonly HVAC contractors involved in replacement of HVAC equipment for homeowners do not pull permits because they believe that there is a low probability of being caught, there are low consequences if they are caught, and that pulling permits would result in higher costs that would cut into profits or the ability to compete with other contractors who do not pull permits.

Appliance and Building Standards Proceeding Energy Savings Analysis

As part of the rulemaking process for adoption of both Appliance Energy Efficiency Standards and Building Energy Efficiency Standards, a statewide analysis is made of the technical potential for energy savings expected to be accomplished through compliance with the Standards. During each proceeding both the IOUs and Energy Commission staff completes Codes and Standards Enhancement (CASE) Initiative studies, investigating the unit energy savings that can be achieved through requirements for specific appliances, or for specific building components or systems. The statewide technical potential savings analysis rolls up these CASE Initiatives studies for all requirements in the proceeding, and applies estimates for the number of appliance or building projects that would be expected to be required to comply with the requirements per year to arrive at statewide estimates. The Appliance Standards estimates are based on test procedure results for prototype examples of each regulated appliance type. The Building Standards estimates are based on building energy simulations of prototype buildings subject to the Standards requirements.

Obtaining reasonable estimates of the statewide number of appliances or buildings that may be subject to the Standards each year is quite challenging. Commonly, sales data for appliances is hard to come by, often not provided by the industry itself. The Appliance Standards program endeavors to use data for appliances that the U.S. Department of Energy requires in their

appliance standards rulemakings, which provide national sales data in particular years with estimates of regional shipments, from which statewide shares can potentially be roughly approximated.

The scarcity of data for the Building Standards is even more pronounced. No statewide database exists for determining the sales of equipment subject to the Standards, and the frequency for which the installation of that equipment is done under a building permit. Also, compiled building permit data, which represents the sole resource for estimating building construction activity, provides only the number of permits processed and the dollar amount of the project costs that are completed under those permits; no data exists related to the type of building improvements that may be subject to Standards requirements. This, in particular, makes estimation of the impacts of requirements for alterations difficult.

The following information from the 2013 Building Standards Impact Analysis (see http://energy.ca.gov/2013publications/CEC-400-2013-008/CEC-400-2013-008.pdf) provides an indication of how statewide impacts are estimated. The approaches described have been similarly used for several Standards update cycles.

Residential Additions and Alterations: The projected savings for newly constructed homes are increased by 43 percent to account for additions and alterations to existing homes. This multiplier is based on the dollar value of 2011 California Industry Research Board (CIRB) new single-family permitted construction compared to addition/alteration permitted construction dollars. It is assumed that permitted HVAC change-outs are included in these alteration estimates.

Nonresidential Lighting, Roofing and HVAC Alterations: The effect of new lighting systems, cool roof requirements and replaced HVAC systems in existing buildings are a result of the differences between the 2008 and 2013 standards. Although the systems and equipment being replaced are expected to have significantly higher energy consumption than those that comply with the 2008 Standards, the savings claimed here are only the additional savings for improvements beyond those already required by the 2008 Standards. The analysis was performed by comparing 2008 compliant buildings to the same buildings with 2013 compliant systems. The results were weighted by the existing floor area in each climate zone. The research team assumed that lighting systems and roofs are replaced every 15 years, meaning that 1/15th of the existing floor area were included in the analysis. The research team assumed that packaged HVAC systems are replaced every 20 years, meaning that modeling runs used 1/20th of the existing floor area in the analysis. Standards requirements for central plant equipment such as boilers and chillers were not included since the research team believes that these types of replacements rarely happen within 30 years, the study period of this analysis. Existing floor area data came from the Non-Residential Construction Forecast.

It should be noted that the estimated energy savings for residential alterations is based solely on permit data. Thus, the savings expected for Standards compliance for alterations that were completed unlawfully without a building permit are not captured in the analysis.

Savings Incorporation in the Demand Forecast

As is captured in greater detail in the subsequent section of this chapter, the Energy Commission's residential and commercial forecasting models, although substantially different from each other, both are economic and demographic models that use statistical conditional demand analysis to arrive at overall statewide demand forecasts. The forecast models have been built up over the past 35+ years with data regarding sectoral and statewide estimates of aggregate energy consumption. Each demand forecast update cycle considers incremental changes to a large number of interacting variables, comparing those changes to overall sectoral and statewide trend data, calibrating potential revisions to the model to avoid contradictions to the incremental change in trend data for that update cycle.

The Energy Assessments Division's Demand Analysis Office considers the Appliance and Building Standards proceeding energy savings technical potential estimates as one input among many in that process. Historically, in representing *existing buildings* in the demand forecast, estimated energy savings from Appliance Efficiency Standards have exceeded those from Building Energy Efficiency Standards. Typically, Appliance Efficiency Standards have helped form the basis of the unit of energy consumption (UEC) for each end-use in the forecast, while Building Energy Efficiency Standards implications were estimated as an incremental percentage improvement relative to that UEC.

The Standards estimates are converted to explicit revisions to the forecasting model inputs, or in some cases, post-processed to generate a final demand forecast. These adjustments taken together enable the Standards proceedings technical potential estimates to be assimilated into the demand forecast, without contradiction of the overall sectoral and statewide trend data indications, which would naturally, internally account for the frequency of occurrence of projects subject to the Standards and the potential for actual energy consumption in buildings to be different than test procedure or building simulation results.

Energy Efficiency Standards Conclusions

As indicated in the Introduction, the Efficiency Division believes that it is important to move to the "existing conditions" baseline required by AB 802. This would enable potentially important additional statewide energy savings, which are currently stranded by the "above codes" baseline philosophy, to be brought into play towards the very challenging task the state has ahead of it to meet the Governor's and Legislature's doubling of energy efficiency mandate by 2030.

The intent of the Appliance and Building Energy Efficiency Standards is to enable energy to be saved in the state's buildings through the installation and use of energy efficient building components, systems and equipment, including controls. The extent to which the potential savings are actually accomplished is dependent on the quality of the installation of these hardware measures, and how they are operated on an ongoing basis. Also, the extent to which state and governmental agencies can compel compliance with the Standards is not infinite; to a large degree achieving the potential energy savings is impacted by voluntary compliance actions in the marketplace. The state's utility programs can play a major part in maximizing the potential savings associated with Standards by improving the quality of installation and the effective operation of the hardware required by the Standards, and improving the level of compliance with the Standards provisions. Also, by using an existing conditions baseline, utilities can encourage the free choice that is made by building owners regarding when buildings and equipment are altered and replaced to be energy efficient, rather than just making repairs that prolong the life of existing conditions at inefficient levels.

One example of actions that can be stranded by a rigid "above code" baseline is retro-commissioning. Retro-commissioning goes well beyond routine maintenance to identify operational improvements that can consistently save energy in nonresidential buildings, which are beyond what the Standards can cause to occur. Retro-commissioning identifies how to modify and calibrate controls that may be required by Standards to optimize their use for individual buildings and building occupants, adding control functions that are not originally implemented or required by Standards.

Another example of actions that can be stranded by a rigid "above code" baseline is achieving energy savings related to Standards provisions, that are not accomplished because building permits are not pulled. As mentioned earlier this energy savings goes uncounted in Standards technical potential analyses, which are subsequently considered for estimation of Standards energy savings for sectoral and statewide demand forecasts. These unrealized and unaccounted for energy savings can be substantial, as indicated by the Strategic Plan to Reduce the Impact of Air Conditioners, completed to respond to AB 2021 (Levine, Statutes of 2006), in which industry experts estimated that an annual peak savings of 130 MW could be achieved by overcoming the failure to pull building permits and achieving quality installation of replacement air conditioners throughout the state (see http://www.energy.ca.gov/2008publications/CEC-400-2008-010/CEC-400-2008-010.PDF, Appendix A).

One strategy of the Energy Commission's Existing Buildings Energy Efficiency Action Plan--consistent with policies in SB 350 and AB 802 to use metered energy consumption to measure of energy savings--is to migrate some downstream incentive programs to energy efficiency resource procurement approaches. Procuring "negawatt-hours" would require establishment of measurement and calculation protocols appropriate for use in contracts, for example at the individual customer or aggregator level, and would necessarily use metered data to derive savings with respect to existing conditions. There is no reason why savings from such efforts

cannot be fully recognized in the state's demand forecast without double counting savings associated with Standards.

An Introduction to the Demand Forecast

Assembly Bill 802 (AB 802) further articulates and defines the Energy Commission's existing authority to collect data from utilities for use in the demand forecast. Future demand forecasts will have a greater emphasis on detailed, localized, and sector-specific analysis of energy demand trends. This more granular analysis will be needed to support the state's policy goals including setting, assessing, and advancing energy efficiency goals set forth in Senate Bill 350 (SB 350).

Because of this change to a to-code baseline authorized in AB 802, the Energy Commission's Demand Analysis Office (DAO) will make modifications to the demand forecast to more effectively understand and project forward the various sources of savings: naturally occurring, from codes and standards, and from ratepayer-funded programs. DAO is currently exploring what specific adjustments will be needed in the forecast, and the streams of data that will be required – which currently does not exist except in anecdotal examples.

Energy Efficiency in Procurement Planning

Since 2009, Energy Commission demand forecasts have been the basis for planning studies that determine authorized procurement of generation by IOUs and transmission system upgrades by the California Independent System Operator and participating transmission owners. These Energy Commission demand forecasts include estimated savings from all energy efficiency programs that are considered committed. Pursuant to the loading order developed by the Energy Commission and CPUC, a further reduction in projected energy demand has been made in these planning studies for additional achievable energy efficiency (AAEE) program impacts even though the savings from these more speculative policy initiatives are less certain. A protocol outlining these agreed-upon adjustments was announced via the *2013 Integrated Energy Policy Report (IEPR)*.[37]

Estimated energy efficiency impacts are incorporated within the Energy Commission's demand forecasts in two ways: through changes to model inputs and through post-processing. The first method is used for most of the committed building and appliance standards implemented since 1975, where average consumption by end-use is adjusted within the commercial and residential models to reflect each updated set of standards. The Energy Commission's Efficiency Division standards impact evaluations are translated to the appropriate geographic and end-use

[37] http://www.energy.ca.gov/2013_energypolicy/documents/2013-11-12_Notice_to_Consider_Adoption.pdf

categories and are incorporated into the demand forecast. The second method, post-processing, is used to capture some of the most recent residential standards, including the water appliance standards adopted in 2015, committed efficiency programs, and AAEE savings. Recent residential standards are handled in this manner (also based on standards impact studies) because staff has not yet had the time to revamp the model properly to adjust the relevant inputs. Committed efficiency programs are subtracted from model output based on utility expected savings, adjusted by evaluation, measurement, and verification (EM&V) studies when available. AAEE savings are derived from CPUC potential studies and subtracted from the forecast, accounting for any overlap that may occur with savings already included.

Demand Forecast Adjustments

A lot is still unknown about the impacts of to-code retrofits. One way to help inform the impacts of to-code retrofits is to start collecting data related to existing buildings and equipment measures to allow an assessment of where the savings potential of to-code programs might be highest. This would require first an inventory of existing data from California Measurement Advisory Council studies, EM&V data, utility audits, other data collection, and recent survey efforts. Any identified data gaps would require additional data collection, with the goal of developing a representative distribution of key actual technical characteristics of existing buildings by vintage. These distributions should be developed to be consistent with the forecast zones and planning areas used in the *IEPR* demand forecasts.

Savings impacts of to-code measures should be assessed by end-use. This requires, for a given geographic area, information regarding the average energy profiles of the more efficient technologies as well as the actual conditions of the technologies being replaced. Geographic aggregation of results should be consistent with the forecast zones and planning areas used in the *IEPR* demand forecasts. A key aspect of this analysis involves determining what constitutes bringing a building up to code. Adjustments to the forecast model inputs would then need to be made to account for the findings from the data collection. This step is designed to develop a more accurate baseline that would then be adjusted for the impacts of to-code programs. The data collected would be used to adjust unit energy consumption, by home or by square foot, or by end-use to reflect actual conditions. These adjustments would be calibrated by estimated historical consumption by end-use developed from metered data and other sources.

Finally, adjustments to the forecast would need to be made to account for the to-code savings identified. Ideally, the savings impacts estimated of to-code measures by major end-use would be translated to adjustments in unit energy savings at the required geographic granularity to allow incorporation directly into the Energy Commission's end-use models. If this is not immediately feasible, to-code savings impacts could be post-processed and model outputs adjusted, as is currently the practice for most utility incentive programs.
Longer-term, a tool to track building energy intensity longitudinally across the state would allow trending in support of the forecast, enable concrete assessment of progress toward the SB 350 goal, and provide important information for policy development and targeting.

Triangulation with program- and sector-specific studies would decrease the uncertainty of impact estimates.

Demand Forecast Conclusions

AB 802 presents a valuable opportunity to utilize new methods for realizing energy efficiency savings within broader efforts to achieve the major increase in savings called for by SB 350. Given current knowledge about the existing buildings, initial analysis indicates that unrestricted to-code programs will: shift some savings from standards to to-code programs; transfer the attribution of some savings from standards *per se* to portfolio programs that support standards implementation; and have a positive impact on total savings going forward through time, though there is considerable uncertainty about the scale of this expansion. The CPUC can choose to restrict programs to those more likely to induce net positive savings, but this can only partly reduce uncertainty about total savings. As more and better data about the existing building stock is acquired, both from general surveys of the population and from in-depth reports of savings from to-code program participants, an improved understanding should emerge.

The demand forecast is meant to provide likely-to-occur scenarios given specific programmatic efforts, rather than projections that automatically assume general policy goals are met. Thus, it is critical to properly estimate net incremental savings from new AB 802 to-code programs relative to the former suite of program opportunities absent AB 802 to-code initiatives. Data limitations will result in high uncertainty in the initial estimates of net incremental savings. Creating realistic estimates of net savings from to-code programs will require that the Energy Commission periodically update the initial estimates as new data and a better understanding of the to-code programs becomes available. The CPUC should properly fund data acquisition about the characteristics of the general population and the performance of specific to-code programs to assure that these programs can tap this portion of overall energy efficiency potential in a manner that is cost-effective in achieving the SB 350's goals.

Attachment: Residential and Commercial Model Documentation

A summary of model documentation for incorporating codes and standards into the residential and commercial models follows.

Residential Model Description and Building and Appliance Standards Incorporation

Model Description and Inputs

The Energy Commission residential forecasting model is an end-use model based on historic utility residential survey data, building simulations, conditional demand analysis, and economic and demographic data and projections.

The model focuses on:

- 3 housing types - single family, multi-family and mobile home.
- 5 housing "vintages" to capture building standards impacts.
- 3 fuel types - electricity, natural gas and other
- 24 residential end-uses

Residential End-Uses

Water heating	Lighting
Backup for Solar Water Heater	Color Television
Pump for Solar Water Heater	Swimming Pool Pump
Dishwasher	Swimming Pool Heater
Incremental water heating dishwasher	Backup for Solar Pool Heater
Clothes Washer	Hot Tub Pump
Incremental water heating clothes washer	Hot Tub Heater
Clothes Dryer	Space Heater
Miscellaneous	Furnace Fan
Cooking Range	Central Air Conditioning
Refrigerator	Room Air Conditioning
Freezer	Evaporative Air Conditioner

The model uses demographic data to predict the number of households. It also uses survey information to determine, for each end use, the average number of appliances found in a typical household. Based on current trends, the model projects the addition and replacement of appliances over time. As new appliances are added, they are assumed to meet applicable efficiency standards in place at the time. The model tracks the number of appliances added under each new vintage of standards and then estimates, on average, how much energy each appliance is likely to use, which is called the unit of energy consumption (UEC).

Space conditioning UECs are based on older building simulation analysis and non-space conditioning appliance UECs are based on conditional demand analysis from existing Residential Appliance Saturation Study surveys and consultant reports along with engineering estimates.

Modeling of Residential Energy Efficiency in Demand Forecast

UECs are the main measure of consumption in the residential model. UECs are benchmarked to their pre-1978 values, as this was the period prior to the introduction of standards. Heating and cooling properties of the building shell are indexed to pre-1975 levels, which is prior to the first building standards requirements.

When new standards are introduced, the index for each impacted end-use is lowered in accordance with the expected percentage savings of the standard on that particular end-use. Likewise, impacts from new building standards are modeled using a similar percentage reduction in heating and cooling loads for homes constructed in and after the year the standard was introduced. Savings for heating and cooling are a combination of both building shell improvements and appliance improvements.

This modeling framework allows staff to estimate the cumulative impact of standards relative to the pre-standards baseline. This is done by running the model with and without adjustments to the UEC indexes and then calculating savings as the difference in energy demand output between the model runs.

The table below identifies standards that are specifically incorporated in the residential model. More recent standards have been post-processed.

Building and Appliance Standards Incorporated in the Residential Forecast Model

1975 HCD Building Standards	1976-82 Title 20 Appliance Standards
1978 Title 24 Residential Building Standards	1988 Federal Appliance Standards
1983 Title 24 Residential Building Standards	1990 Federal Appliance Standards
1991 Title 24 Residential Building Standards	1992 Federal Appliance Standards
2005 Title 24 Residential Building Standards	2002 Refrigerator Standards
	2009 Television Standards
	2010 Lighting Standards

Post-processing

For newer appliance standards (since 2010), post-processing[38] adjustments have been made to estimate end-use consumption based on analysis provided by Codes and Standards

[38] See Post-Processing Appendix at the end of this chapter.

Enhancement (CASE) studies of the Energy Commission's Efficiency Division. Post-processing adjustments have also been made to account for building standards since 2001. This is because of the complexity of fitting the newer building standards (which allow for a more flexible set of measures to gain compliance and focus on previous noncompliance) into the current model structure. Post-processing is also needed to account for many of the residential building standard requirements for both new and existing homes that cannot yet be explicitly included in the residential demand forecasting model. Water heating distribution efficiency, efficient windows, cool roofs, and HVAC duct sealing are examples of measures in the building standards that are not explicitly accounted for in the model.

Commercial Model Description and Building Standards Incorporation

The Commercial Forecast Model (CFM) is an energy intensity model that calculates energy use per square foot based on building type. Like the residential model, the commercial model is an end-use model that is primarily informed by the following input data: Energy Use Intensity (EUI, energy per square foot), floor space, and fuel saturations. Floor space data is figured by building type and year, saturations, and EUIs are figured by building type, end-use, fuel type, and vintage. The CFM projects energy use for 12 building types, 10 end-uses and three fuel types as shown in the table below.

Commercial Forecast Model Inputs

Building Types	End-use	Fuel Type
Small Office	Heating	Electricity
Restaurant	Cooling	Natural Gas
Retail	Ventilation	Oil
Food/Grocery	Cooking	
Warehouse	Water Heating	
Refrigerated Warehouse	Refrigeration	
School	Indoor Lighting	
College/University	Outdoor Lighting	
Hospital	Office Equipment	
Hotel/Motel	Miscellaneous Equipment	
Miscellaneous		
Large Office		

The EUI is the main energy indicator used in the commercial model. Input data EUIs are defined for the base year of 1975 and nine distinct building vintages thereafter. 1975 was selected as the base year since it was prior to the application of building standards and coincided with an onsite survey study conducted during that year from which the original EUI values were estimated.

The EUIs for the base year are defined in kBtu/SqFt, all the subsequent vintages are defined as percentages of the base-year EUIs. At the present time, the EUI input data includes nine building vintages (1975, 79, 84, 92, 98, 01, 05, 08, and 2013) and sixteen climate zones[39] across California. The impacts of the 2016 Standards will be incorporated in the next forecast. These building vintages correspond to cycles of standards, and are characterized by the efficiency levels in effect in each cycle. The relative EUIs reflect changes to the base year values as the result of the impacts of the proposed changes to the standards.

Energy Savings Adjustments

The energy savings from the standards are published in a document called the *Impact Analysis Report*. This report is an integral part of the standards, and it is presented to the public at large as part of the adoption process for each cycle of standards. Commonly, programs are sponsored by IOUs and the savings associated with Building and Appliances standards are determined under the direction of the Energy Commission's Efficiency Division, Buildings Standards Office. The standards affect both newly constructed buildings as well as alterations to existing buildings, both of which are covered in the *Impact Analysis Reports* and include savings estimates for both building type. Treatment of energy efficiency savings in the Energy Commission's demand forecast is similar for new construction and existing buildings, and the explanations provided in this section applies to both.

Once a set of standards is officially adopted, the Demand Analysis Office obtains and considers the estimated energy savings for incorporation in the forecast. The estimated savings must be assigned to building types and end-uses accounted for in the forecast and are converted to a percentage format to be usable in the CFM. The following section describes assignment and conversion process.

Assigning Savings to Building Type and End-use

The estimated savings must first be assigned to the building type, end-use, and fuel type accounted for in the CFM. In cases where the *Impact Analysis Report* is not explicit, savings are assigned to building type(s) and end-use(s) based on the measures' characteristics. For example, the 2013 standards specify requirements for parking garage exhaust fans. However, the standards do not specify the building types and/or the end-uses that would be affected by this measure. Therefore, after careful examination of the characteristics of the measure, the savings are assigned to building types that are most likely to have parking garages. In this particular case, the savings were assigned to miscellaneous end-use of the following building types: large offices, universities, hospitals, and hotels.

[39] This will be expanded to 20 forecast zones for future forecasts.

Format Conversion

As mentioned in the previous section, the CFM's input data EUIs are defined as a percentage of the base-year values. As such, to incorporate programs and standards savings into the forecast, the savings need to be converted to a percentile format. The following example illustrates a sample calculation for the conversion:

Existing cooling EUI for building type i and vintage j = 85.6% of the base-year
Reported impacts of proposed changes to the Standards = 75 GWh
Cooling energy from the latest forecast for building type i and vintage j = 3,260 GWh
% Savings = 75 / 3,260 = 2.3%
Multiplier = 1 – 0.023 = 0.977
New cooling EUI = Existing cooling EUI * Multiplier = 85.6 * .977 = 83.63%

Treatment of Commercial Building and Equipment Decay

The commercial forecast model keeps track of the retirement and replacement of buildings and equipment by vintage using decay functions.

Building Decay

The CFM keeps track of all floor space vintages that make up the entire floor space stock in any forecast year. For example, if the forecast year is 2010, the model keeps track of all floor space added from 1964 to the year 2010 adjusted for decay. Although commercial buildings vary widely in their decay characteristics, a simplified logistic function is assumed to be a reasonable representation of the decay.

Equipment Decay

Equipment decay adds an additional time dimension and complication to the vintaging of floor space. Consider the forecasting year 2010 in the above example, a certain percentage of equipment installed in each of the older building vintages decays and must be replaced. This dating of equipment within building vintages allows for a calculation to estimate the effect of equipment decay. For simplicity, we assume that all decayed equipment is replaced instantaneously and is of the same capacity and fuel type as the original equipment. The equipment decay is estimated using a modified Weibull distribution function.

Price Treatment in Existing Floor Space

Energy prices have a direct impact on the level of energy consumption. The consumption tends to increase when energy prices fall and decrease when energy prices rise. In addition, higher energy prices result in installation of more energy efficient equipment and conservation measures. The CFM is designed to include the effect of energy prices in the forecast, which will be discussed in more detail in the post-processing section.

The impact of energy prices on existing floor space is defined as utilization rate, which is fuel, end-use, building type, and vintage specific. All utilization rates are initially set to one in the base year (1975). The utilization rate in subsequent years is assumed to vary depending on the levels of equipment efficiency, fuel price, and short run utilization (price) elasticities.

Committed Utility Efficiency Program Savings Adjustments (Post-Processing)

Savings from committed utility programs are generally post-processed (adjusted by sector after model runs) in the Energy Commission demand forecasts. The savings are calculated using four steps:

1. Data for first-year efficiency program impacts by efficiency measure are aggregated so that gross GWh impacts can be attributed to categories that align with the Energy Commission end-use models. In the program years where only highly aggregate data is available for the IOUs (1998-2002), allocations are made for residential and commercial programs to specific end-use categories using distributions from the 2003 data. Industrial and agricultural program savings are not separated, as models for these sectors do not operate at the end-use level.

2. Net-to-gross ratios are applied to estimate net GWh impacts by end-use category. This adjustment is intended to account for measure adoptions that would have occurred without the utility program.

3. Realization rates are applied to adjust for real world effects. Although staff assumes that the utilities' estimates of their own portfolio performance are consistent with all relevant mandates, additional data sources such as EM&V reports suggest that the reported impacts may differ from realized impacts. This occurs for various reasons including measures purchased and not installed and lower actual savings per measure than anticipated. EM&V data yielded estimates of realized savings.

4. Residual impacts are estimated for measures beyond the installation year. As is common practice, staff assumed a logistic decay of measure savings, so that 50 percent of installations remain in operation at the end of the estimated expected useful life (EUL). The logistic function models decay in such a way, that installations are taken out of service at a rapid rate shortly before and after reaching the EUL. Note that this differs from the method used by Navigant for AAEE savings where savings disappear after the EUL is reached.

These savings are then subtracted from the model results for the appropriate sectors. For publicly owned utility savings (starting in 2006), staff applies realization rates from IOU EM&V studies in Step 3. For years prior to 1998 (IOUs) and 2006 (publicly owned utilities), staff uses the Energy Commission estimates for historical efficiency program impacts calculated for the *2007 IEPR*. For the later years, staff adds the pre-1998 and pre-2006 historical impacts not yet fully decayed to the later estimates.

All committed utility programs are handled in this manner except for residential lighting. For these programs, residential lighting consumption per household is adjusted within the model to reflect committed program savings through 2015.

In addition, some of the more recent residential standards are currently post-processed since staff has not yet been able to incorporate these directly into the residential model. Savings for these standards are based on Navigant's estimates from the *Energy Efficiency Potential and Goals Study for 2015 and Beyond*.[40]

[40] http://cpuc.ca.gov/General.aspx?id=2013

APPENDIX C:
Lessons Learned from CPUC-IOU To-Code Baseline Pilots

Background

On October 16, 2014, the CPUC issued Decision D.14-10-046 directing the IOUs to conduct "To-Code Pilots" in order to **better understand how much below-code equipment exists that is not being replaced as quickly as it should be through natural turnover or existing programs**. The decision states that Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric Company (SDG&E), Southern California Edison Company (SCE), and Southern California Gas Company (SoCalGas) each have to determine **by how much providing additional incentives, calculated based on existing conditions, increases energy efficiency program participation and achieves greater identified energy savings**. The four utilities submitted an advice letter to approve the pilots in the fall of 2015. This was approved by the Energy Division, but details of execution are still being deliberated.

Energy Division staff is contracted with University of California – Haas School of Business and the E2e project and since early 2015, E2e researchers have been working in close collaboration with commission staff and the IOUs to develop the pilot programs. The pilots are designed to targeted opportunities for savings below-code by providing financial incentives to customers and support for installation. The pilot was designed with an evaluation strategy to show the impact of extra incentives on uptake, energy savings, and cost-effectiveness compared to the status quo. The research design will enable the CPUC and the IOUs to assess the cost-effectiveness of providing additional incentives based on existing conditions. The evaluation will use an experimental design as described in this document and representative of the collaborative process.

Details of the design and the implementation are currently being finalized. The program is expected to launch in early 2016, with preliminary results expected in early 2017.

Lessons learned to date

Pilot development has demanded extensive discussion over the course of the last year. Based on discussions with field staff and the IOUs – the claims for significant potential for below code savings continue to be strong. Visits to the field have revealed below-code equipment in a non-representative sample and industry experts describe it, but it has not been quantified. However, several challenges have presented themselves in selecting measures and in designing and experimental evaluation. These challenges may or may not prove similar in wide scale attempts to design to-code programs in the future.

The gas pilot is still under development, with only minor implementation components remain to be resolved including:

- Final rebate structure
- Outreach protocols and requirements for documentation at point of intervention

The electric pilot has several remaining issues and may be undergoing a significant redesign compared to the submitted advice letter programs. These are due to limitations of focusing only on highest efficiency lighting fixtures which included:

- Finding measures that are long lived (per Commission direction) lead to a focus on LED fixture replacements, but alone present several challenges for program design because they:
    - cost significantly more (~3x) than the "competing" measures like linear fluorescent bulbs,
    - don't offer significantly more savings (only ~10% more)
    - LED measures are likely not to be adopted by customers, regardless of if the incentive associated with below code savings are included or not.
- The IOUs, researchers and Commission staff are now considering proposals to expand to multi measure interventions that would still be compliant with expectations for long term savings and a meaningful test of the opportunities for below code savings.

Evaluation Design

The evaluation is comprised of two experimental research designs, which will be implemented in parallel: one for equipment operated by gas and one for equipment operated by electricity.

In both studies, the end-use equipment eligible for rebates were selected on the basis of the following criteria on:

(a) Industry experts expect considerable below-code equipment to exist,
(b) Above code technology is available,
(c) Rebates based on energy savings, using existing conditions as a baseline, could render the above code technology cost effective for many customers, and
(d) Sufficient take-up to generate sufficient statistical power was expected.

We also decided to focus on the small-medium business segment, where:

(a) There seems to be enough below code equipment,
(b) There are enough establishments to generate statistical power, and
(c) Utilities are interested in better serving this segment.

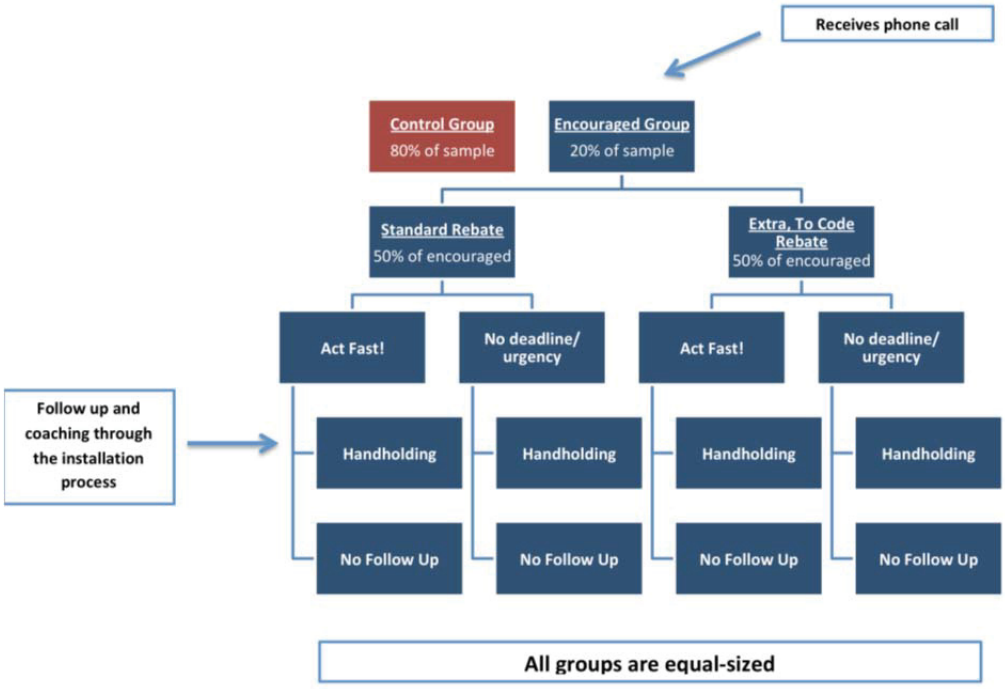
The **Gas Pilot** will cover SoCalGas' territory and focus on the **small boiler** segment. Available data from SoCalGas suggests that below-code boilers are common among small and medium commercial customers. Moreover, it seems plausible that the below-code incentives offered under the pilot will be sufficient to accelerate cost-effective replacement of this below-code equipment.

The Electricity Pilot will target electricity end-use equipment and run across the service territories of
PG&E, SCE, and SDG&E. Lighting was originally identified as the most promising class of measures to target because administrators assert that below-code lighting is ubiquitous across all three territories and because there appears to be cost-effective opportunities to replace this

equipment with above-code equipment. In further development of the pilot, administrators and researchers are reconsidering expansion of the breadth of the measure mix to be included.

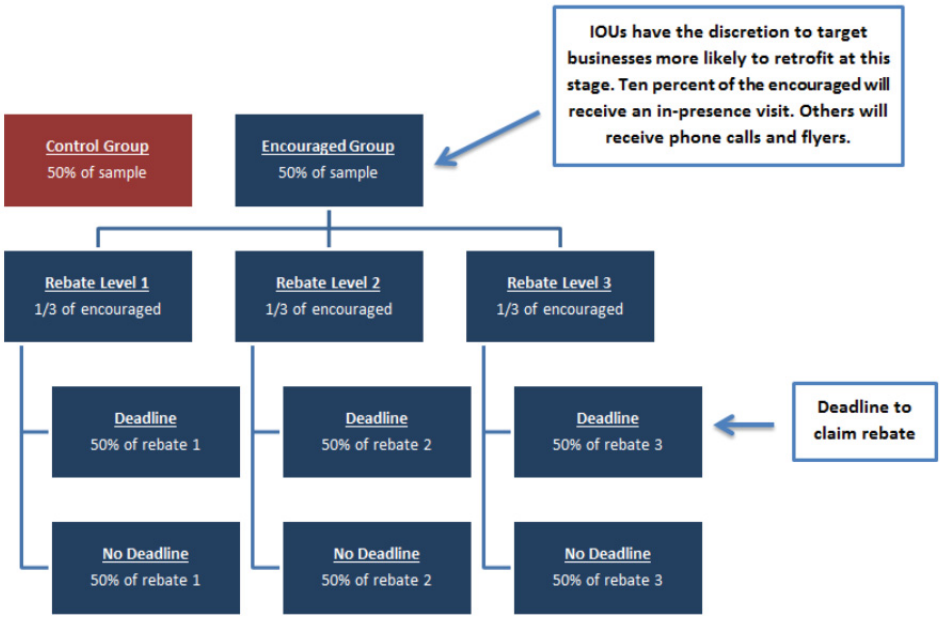
The next two figures summarize the treatment groups, highlighting the differences in each of the studies. Figure 1 summarizes the design for the gas studies, the electric pilot is expected to be redesigned, but Figure 2 shows the original design. Randomization of treatment and control groups will occur prior to the launch of the study.

Figure 1: Gas Pilot



Clients randomly assigned to the encouraged group will receive a phone call from SoCalGas offering a free audit of their boilers (and potential rebates). Based on the data collected during this audit, SoCalGas will present a "retrofit proposal" to the customer, outlining potential savings and rebates level if they decide to retrofit. "Handheld" businesses will receive additional assistance from SoCalGas, who will guide them through the retrofit/installation process. E2e researchers will collect data on whether the customer decided to retrofit the audited boiler(s) or not.

Figure 2: Electricity Pilot



Unlike the gas study, in the electricity pilot, IOUs will be given a list of businesses to encourage and will have the discretion to identify the 10% of businesses they believe are the most likely to retrofit. This 10% will receive an in-person visit in addition to the phone calls and flyers that the rest of the encouraged group will receive. This choice was made in order to utilize the existing knowledge that IOUs and their implementers have about businesses in their territories. Additionally, E2e researchers are testing three different levels of rebate and the impact of imposing a deadline to retrofit. All else is identical to the gas study.

APPENDIX D:
Technical Analysis of AB 802

[separate file]

(END OF ATTACHMENT)